Progress report of the Perioperative Mortality Review Committee

Report to the
Health Quality & Safety Commission New Zealand

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- Epidemiological support provided by the University of Otago.
- Data collection system project support provided by Health Partners Consulting Group.

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Executive summary

The Perioperative Mortality Review Committee's (the Committee's) role is to review and report on perioperative deaths with a view to reducing mortality and morbidity, and thereby improving the quality and safety of health and disability services in New Zealand. With a volume of between 4000 to 5000 deaths following an operative procedure each year, the Committee has taken the approach to focus on specific classes of perioperative deaths where lessons can be learnt to improve perioperative care.

Tracking perioperative mortality

The Committee has analysed perioperative mortality on a five-year rolling basis since its first report in 2011. For some procedures, these have been tracked to identify trends in mortality over time.

Table 1: Cumulative 30-day mortality (per 100,000) 2005–2011

Topics reported over time	Cumulative 30-day mortality rate per 100,000		
	2005–2009	**2006–2010**	**2007–2011**
Cholecystectomy: acute		1040.9 (1%)	975 (1%)
Cholecystectomy: elective		164.6 (0.16%)	151 (0.15%)
Colorectal resection: 45 yrs+ acute	9818.3 (9.8%)		8456 (8.5%)
Colorectal resection: 45 yrs+ elective	2057.7 (2.1%)		1700.6 (1.7%)
Hip arthoplasty 45 yrs+ acute	7268.6 (7.3%)		6608.9 (6.6%)
Hip arthoplasty 45 yrs+ elective	235.3 (0.24%)		180.5 (0.18%)
Low-risk anaesthesia (ASA* 1 & 2, elective)		68.8 (0.07%)	62.8 (0.06%)
Pulmonary embolism (cause of death): acute		54.5 (0.05%)	61.6 (0.06%)
Pulmonary embolism (cause of death): elective		7.6 (0.008%)	8.7 (0.009%)
Cumulative 1 day mortality			
General anaesthesia	119.08 (0.12%)		125 (0.13%)

* ASA = American Society of Anesthesiologists

When comparing cumulative 30-day mortality rates for 2007–2011 with 2005–2009, the number of deaths has decreased for colorectal resection,and hip and knee arthoplasty. Mortality has also decreased for cholecystectomy and elective admissions (American

Society of Anesthesiologists (ASA) score of 1 or 2) comparing the same period with 2006–2010. In contrast, mortality has slightly increased in pulmonary embolism deaths (as a *cause of death*) and within one day of general anaesthesia.

While the tracking of these mortality rates reveals a positive shift overall, these results should be interpreted with caution. It is, however, encouraging that there is a general downward trend in New Zealand's perioperative mortality for a number of the areas analysed.

International benchmarking

International benchmarking of these data remains a challenge. There are, however, efforts to make this possible, with the World Health Organization (WHO) proposing standardised metrics for global surgical surveillance.

The Committee has investigated particular WHO-proposed standardised public health metrics for global surgical surveillance:

- day of surgery death ratio
- postoperative in-hospital death ratio
- number of operations for 10 common procedures
- proportion of deaths on day of procedure (10 common procedures)
- inpatient deaths (10 common procedures)

For New Zealand, the day of surgery mortality rate per 100,000 for the period 2007–2011 was 94.2 (0.09 percent). The postoperative in-hospital death rate per 100,000 for the period 2007–2011 was 383.3 for all surgical patients and 359.9 for all patients who underwent a general anaesthetic (both 0.4 percent respectively).

Form development

The past year's activities of the Committee have focused on the development of an integrated form to collect data on perioperative mortality that enhances that already held by national collections and of mutual interest to the Royal Australasian College of Surgeons (RACS), the Australian and New Zealand College of Anaesthetists (ANZCA) and private and public health facilities. These forms are included in the appendices.

The Committee now moves to its implementation phase and plans to conclude the piloting of this integrated review form. This will include further work with both public and private health facilities to avoid duplication of effort and enhance existing systems.

Case review

Specific case review is an important component of understanding perioperative mortality. A working group has been formed to investigate endoscopy-related mortality in particular. This aligns with the Committee's scope. Cases have been drawn from the National Non-Admitted Patient Collection (NNPAC) for 2011. There were 135 cases identified as potentially following an endoscopy. A subset of these cases has been selected for review.

Composite case studies will continue to be developed by the Committee for a range of scenarios.

Recommendations

The following recommendations are informed by this progress report and the preliminary findings of perioperative mortality data for 2007–2011.

The Committee recommends for *improving perioperative care* that:

- optimal care pathways are evaluated in the context of assessing mortality following acute surgery for those aged over 80 years
- a continuing focus on promotion of formal preoperative assessment for the risk of venous thromboembolism is warranted given the apparent minor increase in pulmonary embolism mortality (7.6 per 100,000 elective, 2006–2010; 8.7 per 100,000, 2007–2011).

The Committee recommends for *system development* that:

- standardised perioperative mortality reporting is promoted to, and further developed with, a sample of District Health Boards and private facilities
- further piloting of a perioperative mortality review database occurs at the health care facility level
- Stage Two of piloting commences, involving both *internal* and *external* peer review of the proposed data fields with modification as necessary.

The Committee recommends for *further analysis* that:

- the proposed WHO Patient Safety Programme's standardised public health metrics for surgical care are incorporated into perioperative mortality analysis and reporting
- the standard out-of-hospital death notification process be explored as a mechanism to identify deaths that occurred within 30 days of an operative procedure and after discharge
- the Commission considers developing a resource on Hospital Standardised Mortality Ratios.

Introduction

The Perioperative Mortality Review Committee (the Committee) was established in April 2010. Their role is to review and report on perioperative deaths with a view to reducing mortality and morbidity, and thereby improving the quality and safety of health and disability services in New Zealand. The Committee achieves this by designing strategic plans and methods to reduce mortality and morbidity.

Perioperative deaths are defined as any death that occurred following an operative procedure within 30 days or after 30 days but before discharge to home or a rehabilitation facility. Perioperative deaths also include deaths that occurred while under the care of a surgeon in hospital, even though an operation was not undertaken.

Operative procedure is broadly defined and includes gastroscopies, colonoscopies and cardiac or vascular angiographic procedures (diagnostic or therapeutic) carried out in designated endoscopy or radiological rooms as well as operative procedures.

In some cases, the procedure itself may be a small factor in a complex episode of care and play no part in the later death of the patient, while in a small number of cases there are important lessons to learn. Despite the procedure itself potentially being a minor factor in some causes of death, nevertheless there are between 4000 and 5000 deaths following an operative procedure in New Zealand each year (POMRC 2011). With this volume of reported mortality, the Committee has taken the approach to focus on specific classes of perioperative deaths where lessons can be learnt about health systems and care of the patient along the perioperative journey.

The Committee is now in its fourth year of operation and is moving into its implementation phase to embed a national perioperative mortality reporting system at the health facility level. A national reporting system will enable in-depth analysis of the factors leading to perioperative mortality across relevant diagnostic and procedural categories. This will consequently allow contextual analysis of perioperative mortality to complement the data extracted and analysed from the National Minimum Dataset (NMDS), National Mortality Collection (NMC), National Non-Admitted Patient Collection (NNPAC), and the Coronial Case Management System (CMS).

The following report contains:

- a summary of the Committee's progress to date
- progress against previous report recommendations and proposed actions
- an overview of what is now known about New Zealand's perioperative mortality
- progress on the development of integrated perioperative mortality data collection
- investigating and expanding existing data sources
- an update on the Endoscopy Working Group
- a composite case study
- recommendations and priorities to action.

Table 2: Areas of mortality analysis from 2005 to 2011

	Mortality 2005–2009	Mortality 2006–2010	Mortality 2007–2011
Hip arthroplasty (45 yrs+)	√	–	√
Knee arthroplasty (45 yrs+)	√	–	√
General anaesthesia	√	–	√
Colorectal resection (45 yrs+)	√	–	√
Cholecystectomy	–	√	√
Pulmonary embolism	–	√	√
Elective admissions (ASA* 1 & 2)	–	√	√
Cataract surgery	√	–	
Postoperative mortality (>80 yrs)	√	–	

* ASA = American Society of Anesthesiologists

Committee progress summary

The following table provides an overview of the main activities of the Committee since its inception. The early focus of the Committee in the establishment phase was to build awareness of the committee, share and develop its plans with the health sector, publish data on perioperative mortality and develop a process for consistently collecting national perioperative mortality data to enhance that collected by administrative datasets.

Table 3: Committee progress 2010–2014

Establishment phase			**Implementation phase**
Year one (July 2010 – June 2011)	**Year two (July 2011 – June 2012)**	**Year three (July 2012 – June 2013)**	**Year four (July 2013 – June 2014)**
Committee establishment	Inaugural report published February 2012	Committee at full membership	Publication of progress report (March 2014)
Sector engagement/consultation	Sector engagement/consultation	Sector engagement/consultation	Publication of further national perioperative mortality data (June 2014)
Data scoping	Developing data analysis methodology	Publication of second report	Second workshop (June 2014)
Determine reporting focus	Reviewing additional data collection modalities	Endoscopy Working Group established	Endoscopy case review
Transition from Ministry of Health to Health Quality & Safety Commission		Inaugural workshop (June 2013)	Integrated review form piloted internally and externally
		Development of integrated perioperative mortality review form	National perioperative mortality data collection infrastructure developed

The Committee now moves to its implementation phase and plans to conclude the piloting of its integrated review form, both internally and externally, so that the infrastructure for national perioperative mortality data collection can be developed. This will include further work with both public and private health facilities to avoid duplication of effort and enhance existing systems. The Committee will further develop a case review process, particularly via the Endoscopy Working Group.

Previous report recommendations: progress summary

Below is a summary of progress made against the two previous reports of the Committee.

Table 4: Progress summary of second report recommendations

Recommendations of second report (March 2013)	**Progress to date** (March 2014)
All patients should be formally assessed preoperatively for risk of venous thromboembolism and appropriate thromboprophylaxis implemented, taking into account the individual risk/benefit profile.	Raising the profile of venous thromboembolism risk will be part of the Commission's 'Open for Better Care' campaign.
All health care professionals should participate actively in the World Health Organization Surgical Safety Checklist, including the question on thromboprophylaxis.	The Perioperative Harm Advisory Group of the Commission is actively promoting the use of the checklist to improve teamwork and communication.
To assist informed consent, information should be available for patients concerning the risk of dying within 30 days of any procedure that has significant risk of mortality.	Reports of this Committee (reporting mortality on a five-year rolling basis starting from 2006) will shape the development of informed consent resources for patients. This will be developed in conjunction with the Consumer Engagement team of the Commission. Data from the reports have been used in clinical teaching.
Non-operative care pathways should be developed and used when surgical procedures are deemed inappropriate because of excessive risk.	This has been raised with the Royal Australasian College of Surgeons and the Australian and New Zealand College of Anaesthetists and is supported.
Case studies are developed to highlight current good practice or recommend practice change.	The inaugural workshop of the Committee used case studies in highlighting good practice and areas for practice improvements. A similar scenario will be developed for the June 2014 workshop.
Psychosocial issues contributing to mortality following procedures require further investigation.	There is potential to collaborate with the Suicide Mortality Review Trial.
Given the relative mortality of acute (1.0%) and elective (0.16%) cholecystectomy, further research is conducted into the management of acute cholecystitis.	Preliminary analysis has been completed and a summary is included in this report. Further analysis will be reported at the second workshop of the Committee in June 2014.

Mortality following acute surgery for those aged over 80 years needs further assessment and discussion with health care professionals so that optimal health care can be planned.	This will be a focus of the 2015 report.
There is a continuing focus on ASA 1 and 2 elective surgery mortality (as, for these patients, a positive outcome was anticipated).	Preliminary analysis has been completed and a summary is included in this report. Further analysis will be reported at the second workshop of the Committee in June 2014.

Table 5: Progress summary of inaugural report recommendations

Recommendations of inaugural report (February 2012)	**Progress to date** (March 2014)
A whole-of-system perioperative mortality review process is developed which builds on the NMDS and the NMC. This would include the accurate and systematic recording of patient and procedure details from all health care facilities and practitioners.	An integrated form has been developed to collect data across all health care facilities.
Key components: The enhancement and standardisation of existing data collections and current mortality review processes to ensure a uniform, efficient and meaningful national methodology.	The system developed first identifies clinically important groups of procedures for investigation and uses Australian Classification of Health Interventions (ACHI) codes to select these procedures and reviews 30-day mortality using NMDS and NMC. Other methodologies were investigated resulting in a number of lessons learned: • Selection of cases based on the presence of surgical subspecialty codes in the NMDS would have resulted in a large number of operative procedures being excluded from analysis. • The use of anaesthetic codes in isolation would be insufficient to identify all procedures under the Committee's scope. • Denominator for total perioperative mortality rates cannot be readily identified via the NMDS. The denominator is more complete when using Statistics New Zealand data. • NMDS and NMC review is cost-effective and provides useful baseline information. There is nearly complete coverage of publicly funded procedures and relatively complete demographic information. • Private hospital coverage is incomplete, particularly private day-stay providers.

	• This methodology provides limited contextual information. However, it does provide important baseline information. • A stocktake of local mortality review processes has been completed.
A coding mechanism that recognises both procedures and deaths within the remit of the Committee. This will require investigation to determine optimal methodology.	Reviewing perioperative deaths requires a 'flag' in the system for early identification of cases. This can be achieved in a number of ways. The Burial and Cremation Act 1964 remains under review. The Health Quality & Safety Commission responded to the Law Commission's consultation regarding this Act. The Act review also queried whether the circumstances in which doctors are required to report deaths which are 'without known cause' or deaths which occur 'during medical, surgical, or dental operation, treatment, etc.' need to be better defined under the Coroners Act 2006. The Committee recommended consideration of additional definitions in relation to medical or surgical procedures and anaesthesia. A recommendation was also made to include deaths that occurred before a person was discharged from hospital following an operation or procedure, or that occurred within 30 days of an operation or procedure of that kind.
The development of a national standardised perioperative mortality review form that will be common to all health care facilities and practitioners. This form will enable and facilitate additional data collection and peer review processes.	This recommendation is key to understanding contextual information around perioperative mortality. This will be the focus of the next work plan.
Secure national data storage hosted by, and under the guardianship of, the Health Quality & Safety Commission.	All data is either stored or handled at an 'In Confidence' level of security.
The ability to carry out whole-of-system and focused (sub-group) analysis of both qualitative and quantitative data.	This has been developed on a quantitative level and is being investigated at a qualitative level.
The ability to report at a number of levels (national, regional, within health care facility) and to a variety of audiences, including consumers and the wider community.	Endoscopy Working Group established. Form being developed to enable national, regional and local reporting.
The ability to generate evidence-based, peer-reviewed recommendations for reinforcing current 'good practice' or system improvements leading to practice change.	As methodologies for data collection and analysis are developed, the Committee will be able to formulate more specific recommendations.

Formalised Memorandum of Understanding between the Committee and Coronial Services to enable enhanced and standardised data access.	A central process has been established for contact with Coronial Services and the mortality review committees.
Work with the National Health Board to ensure that the NMDS and NMC collections are enhanced and standardised by: • ensuring that the ASA score is recorded for all procedures • separately identifying existing conditions from those acquired during that admission • ensuring that the immediate cause of death can be identified from the data collections.	The National Health Board and mortality review committees have worked together to improve data capture. This remains an iterative process as data collection and reporting systems are further developed.
Submission of data to the NMDS is mandatory for all health care facilities.	Following sector consultation, this recommendation has been well received from both the public and private sectors.

What do we know so far about New Zealand's national perioperative mortality?

The Committee has now been analysing national datasets for three years, investigating perioperative mortality in specific areas on a five-year rolling basis (2005–2009, 2006–2010, 2007–2011). As noted in the inaugural report, with a population of approximately 4.3 million people, it is possible for New Zealand to collect data nationally where other jurisdictions need to collect regional or provincial data. This whole-of-system oversight possible in the New Zealand context provides a unique opportunity to understand perioperative mortality on a national basis, and identify system issues and contributory factors leading to perioperative mortality.

This report presents an overview of data analysed to date and the provisional results of analysis of perioperative mortality for 2007–2011 for selected procedures. These provisional results will be finalised and presented in depth in a subsequent report to be published in June 2014. Table on page 5 provides a summary of what is now known about New Zealand's perioperative mortality rates.

Overall, when comparing the 2007–2011 period with 2005–2009 and using cumulative 30-day mortality per 100,000 as the unit of measurement, the number of deaths has decreased for colorectal resection, and hip and knee arthroplasty. Similarly, mortality has decreased for cholecystectomy and elective admissions (ASA score of 1 or 2) comparing the same period with 2006–2010. In contrast, mortality has slightly increased in pulmonary embolism deaths (as a *cause of death*) and within one day of general anaesthesia. The number of admissions has remained relatively consistent in these datasets.

While the tracking of these mortality rates reveals a positive shift overall for specifc procedures and elective admissions, these results should be interpreted with caution. As the Committee further tracks these mortality rates, the statistical significance of these will become apparent. It is important to note that there is an unknown proportion of private elective procedures missing from these data. It is, however, encouraging that there is a general downward trend in New Zealand's perioperative mortality for several of the areas analysed.

It remains a challenge to benchmark or compare New Zealand's perioperative mortality data internationally. There are few international reports that consider perioperative mortality across a whole health system, especially relating to surgical procedures. Comparisons between countries, regions or hospitals require adjustment for varying mortality risks that occur with different mixes of population demographics, illnesses and other characteristics. Similarly, there are major differences in how hospitals and health care systems are organised and how data are collected across these systems.

There are increasing efforts to improve standardisation of data collection and reporting and, therefore, increase the possibility of international comparison with other jurisdictions. For instance, the World Health Organization (WHO) has developed proposed standardised public health metrics for surgical care summarised below.

The *WHO Guidelines for Safe Surgery* (WHO 2009) recommend that for surgical surveillance at the national level, the following data should be collected systematically by WHO member states:

- number of operating theatres
- number of surgical procedures performed in an operating room
- number of trained surgeons and number of trained anaesthetists
- day of surgery mortality rate
- postoperative in-hospital mortality rate.

The Committee has looked at the last two metrics listed here: day of surgery and postoperative inpatient deaths.

Table 6: WHO's proposed standardised public health metrics for surgical care analysed by the Committee

	Definition	Rationale for use
Day of surgery death ratio	Number of deaths on the day of surgery, regardless of cause divided by number of surgical procedures in a given year or period, reported as a percentage.	This ratio allows health care systems to assess performance and have a snapshot of the health status of a population.
Postoperative in-hospital death ratio	Number of deaths in hospital following surgery, irrespective of cause and limited to 30 days, divided by the number of surgical procedures done in a given year, reported as a percentage.	Understanding this ratio provides an understanding of the risks associated with surgical interventions.

The day of surgery death ratio can be equated with the analysis of general anaesthesia deaths as presented in the Committee's inaugural report and provisionally presented here with adjustment for *same day*. The challenge for exploring this metric and providing an overall day of surgery mortality rate and postoperative mortality rate as defining and identifying all admissions undergoing surgery and then identifying the day of the procedure (which can be multiple).

Despite challenges inherent in exploring this particular metric, the Committee will continue to investigate its use and work with other metrics to explain New Zealand's rates of perioperative mortality and draw from international examples where appropriate.

In addition, the WHO guidelines also recommend the following measures for countries with more advanced data capability:

- number of operating rooms by location: hospital, ambulatory, public private
- number of trained surgeons by specialty
- number of other surgical providers
- number of trained anaesthetists
- number of perioperative nurses.
- number of surgical procedures performed in operating rooms for the 10 most frequent procedures in the country, emergent or elective
- proportion of deaths on the day of surgery by procedure for the 10 most frequent procedures in the country
- proportion of in-hospital deaths after surgery by procedure for the 10 most frequent procedures in the country.

The Committee will investigate these metrics in future reports. Table 7 presents draft results to describe the total number of inpatient surgical procedures provided in New Zealand (2007–2011), the proportion of same-day fatalities and the proportion of inpatient deaths related to the admissions.

Table 7: Inpatient deaths for all surgical procedures

	Number of deaths on same day as operation 2007–2011 *(Deaths within 1 day of GA)*	Number of deaths as inpatient 2007–2011	Number of admissions 2007–2011	Day of surgery mortality rate per 100,000 2007–2011 (% all admissions) *(Deaths within 1 day of GA)*	Inpatient mortality rate per 100,000 2007–2011 (% all admissions)
All surgical patients (S specialty)	1,575	7,527	1,963,679	80.2 (0.08%)	383.3 (0.4%)
Deaths related to patients who undergo a general anaesthesi	*1,465*	4,326	1,167,573	*0.1%*	359.9 (0.4%)

Table 8: New Zealand's perioperative mortality: selected procedures and cause of death

	Proportion – Up to 30 days post-surgery			**Rate – Cumulative 30-day mortality per 100,000**			**International comparison**
	2005–2009	***2006–2010***	***2007–2011****	**2005–2009**	**2006–2010**	**2007–2011****	
Procedure: Cholecystectomy	–	*120 deaths/29,473 admissions*	*118 deaths/30,157 admissions*	–	1040.9(1%) *acute* 164.6 (0.16%) *elective*	975 (1%) acute 151 (0.15%) elective	Similar to United States (US) (0.53%). (Yu et al 2011)
Procedure: Colorectal resection (45 yrs+)	*652 deaths/16,238 admissions*	–	*557 deaths/16,760 admissions*	9818.3(9.8%) acute 2057.7(2.1%)elective	–	8456(8.5%) acute 1700.6(1.7%) elective	Similar to US for elective operations but lower mortality with emergency procedures (US 15% mortality for emergency operations and 1.9% elective). (Ingraham et al 2010) 15% following acute surgery in Hong Kong. (Kwan et al 2008) Denmark reported significant variation between providers (3.5–44%). (Iversen 2012)
General anaesthesia	*1387 /1,164,764 anaesthetics*	–	*1465/1,167,573 anaesthetics*	119.08 (0.12%)	–	125 (0.13%)	

Anaesthesia High-risk: 80 years and older	*2799 deaths/62,230 initial anaesthetics*	–	–	9008.6 (9%) *acute* 1210.9 (1.2%) *elective*	–	–	Lack of relevant national audits makes comparison difficult.
Anaesthesia Low-risk: Elective Admissions (ASA 1 and 2)		*259 deaths/376,454 initial anaesthetics*	*198 deaths/395,981 initial anaesthetics*		*68.8 (0.07%)*	62.8 (0.06%)	Broadly consistent but rarely specifically reported. (Bainbridge et al 2012)
Cause of death: Pulmonary embolism	–	*241 deaths/1,259,032 – general anaesthetic or neuraxial block* *241 deaths/2379 – pulmonary embolus associated admissions*	*276 deaths/1,268,035 (0.02%) – general anaesthetic or neuraxial block* *276 deaths/2312 – (11.9%) pulmonary embolus associated admissions*	–	54.5 (0.05%) *acute* 7.6 (0.008%) *elective*	61.6 (0.06%) acute 8.7 (0.009%) elective	Broadly similar to Japan (0.08%) (Sakon et al 2004) and lower than the estimate for the general Western surgical populations (0.9%). (Geerts et al 2001) The New Zealand figure includes mortality of inpatients and up to 30 days, consistent with evidence that thromboembolism may occur days after surgery post-discharge.

Procedure: Hip arthroplasty (45 yrs+)	*635 deaths/37,266 admissions (45 yrs+)*		*578 deaths/38,624 admissions (45 yrs+)*	7268.6 (7.3%) *acute* 235.3 (0.24%) *elective*		6608.9 (6.6%) acute 180.5 (0.18%) elective	UK reports hip fracture mortality at 10%. (Based on acute admissions for fracture only.) (Dr Foster Intelligence 2011) 0.3% elective rate reported for the US (Liu et al 2009) and slightly higher in Japan. (Kadono et al 2010)
Procedure: Knee arthroplasty (45 yrs+)	*53 deaths/26,000 admissions (45 yrs+)*		*52 deaths/26,899 admissions (45 yrs+)*			169.7 (0.17%) elective	
Procedure: Cataract surgery (45 yrs+)	*135 deaths/86,514 admissions (all ages, 98.9% elective)*	–	–	161.7 (0.2%) *elective*	–	–	

*Preliminary results
**Preliminary results

Progress on integrated perioperative mortality data collection

The inaugural report of the Committee recommended building upon existing data collection systems to enable the establishment of a whole-of-system perioperative mortality review process. The Committee noted that this would be a system that could be used by both the public and private sectors, a coding flag identifying admissions of interest would be ideal and any system developed would clearly differentiate between pre-existing conditions and those that resulted in the postoperative death of the patient. For instance, while colorectal cancer may have resulted in admission and death following surgery, if the patient hypothetically developed sepsis post-operatively, this would be of more clinical relevance to improving systems (POMRC 2011). A whole-of-system overview would also be supplemented by in-depth case review to further understand those deaths that were potentially avoidable and where systems enhancements could be made.

In the past year the Committee commissioned a project to develop an integrated form to collect multidisciplinary data following a death under the Terms of Reference of the Committee (Health Partners 2013). This project worked in close collaboration with the Committee, the Health Quality & Safety Commission and wider stakeholders; notably the Royal Australasian College of Surgeons (RACS), the Australian and New Zealand College of Anaesthetists (ANZCA) and the Ministry of Health.

The project also aimed to document a data dictionary for ongoing collection based on, and using data defined, collected and stored within, other health data sets (eg, NMDS, Mortality Collection, professional colleges and societies, and health care facilities).

There were a number of pre-defined parameters determining that the data must be:

- collected for all patients operated on in a way that is confidential and robust
- defined and gathered consistently and in a way that can be interpreted across multiple facilities and used by multiple facilities
- relevant to enhancing root cause analysis
- collected in a way that is cost-efficient.

With the multiple processes already established, an important principle of developing a national perioperative mortality review data collection system was building on existing systems and avoiding duplication of effort where data has already been entered and audited.

The Child and Youth and the Perinatal and Maternal Mortality Review Committees each have established networks of local coordinators at the health care facility level. The management and review of mortality data can be managed at the local level through these networks in the case of these classes of deaths. Perioperative deaths are reviewed variably at the local level across health care facilities, with some facilities conducting in-depth multidisciplinary reviews and others having little resource to undertake such review activities.

Deaths occurring in health care facilities

Following a perioperative death, there are a number of journeys that data can take, from internal quality and safety case review, to referral to the coroner, the Accident Compensation Corporation (ACC) or the Health and Disability Commission (HDC). Data also feeds into national reporting mechanisms such as Mental Health Act reporting, serious and sentinel event reporting and mortality review committee reporting. The Royal Australasian College of Obstetricians and Gynaecologists (RANZCOG), RACS and ANZCA also have processes that use these data.

The national perioperative mortality data system will collect data on any incidents or remedial factors of care leading up to the death of the patient and be multidisciplinary in approach ensuring multiple perspectives. These data will be collected predominantly to look at the systems and processes leading to the perioperative death rather than proportioning blame to individuals.

Data entered at the local facility level would be linked to national data collections, enabling a quantitative overview that is supplemented with a case review approach. Collection of perioperative mortality data will be via a web-based form that will link with other data collection systems.

The data fields have been designed to incorporate data elements required by RACS and ANZCA as part of their mortality audits.

Deaths occurring outside health care facilities

For those deaths that have occurred within 30 days and after discharge from a hospital or other health care facility, another mechanism for reviewing these deaths will require development.

Notification of death is managed by the Department of Internal Affairs. Death notifications are shared with Statistics New Zealand, the Ministry of Health and other relevant governmental organisations. It is the Ministry of Health that links the death with a National Health Index (NHI) number. One use of these data is for a list of notified deaths to be sent to each health care facility so that records can be updated and the risk of making appointments for recently deceased patients can be minimised. All discharges are coded and sent to the Ministry of Health within 28 days of the month of discharge. Most deaths are notified within one month and data will be wholly complete within three months.

Using this mechanism to identify deaths that occurred within 30 days and after discharge will be further investigated by the Committee once the in-hospital component has been tested and established.

Case review

A sub-set of cases will be identified from the in-hospital and outpatient deaths for in-depth analysis. The area of focus will be clinician-led and concentrate on areas where it is believed that further analysis is warranted. Some examples include:

- Specific procedures (eg, cholecystectomy). Based on coded procedures, and/or text descriptions.

- Specific diagnoses (eg, gall bladder disease). Based on coded diagnoses, and/or text descriptions.
- Specific area of concern (eg, deep vein thrombosis). Might examine those with/without the condition, for specific procedures, for specific settings, details about the specific interventions given, their timing in relation to the adverse outcome.
- Specifically mentioned interventions (eg, central line insertion).

Specific reviews are likely to be prompted by an individual facility having a concern in a specific area and seeking more detail on the best approach.

Impact on health workforce

The success of a meaningful national perioperative mortality database is dependent on the participation of all practitioners involved in perioperative care and the systems that support these practitioners.

It is estimated that a surgeon will typically encounter about five reports per year on average (or one every two months). For anaesthetists, there would be around nine reports per year in average (or one every six weeks). This is based on 911 surgeons having practised in New Zealand (excluding obstetrics and gynaecology, and paediatrics) and 582 anaesthetists (Health Partners Consulting Group 2013).

Next steps

To conclude the piloting of the process to integrate perioperative mortality data collection, these questions will need addressing:

- Does the integrated perioperative mortality data form have all necessary elements (or too many elements)?
- How user-friendly is the form and can it be realistically incorporated into existing processes? (Conversely, how can the administrative burden be minimised?)
- How long does it take to source the information and complete the form?
- What elements can be pre-populated and to what extent can the form be automated?

Investigating and expanding data sources

Perioperative mortality data has been collected from a variety of sources since the Committee's inception. It has been determined that the following data sources provide useful baseline data:

- National Minimum Dataset (NMDS)
- Mortality Collection (NMC)
- National Non-Admitted Patient Collection (NNPAC)
- Coronial reports
- Joint registry (New Zealand Orthopaedic Association) – *currently being accessed by the Committee.*

The NMDS and NMC are central to having a statistical oversight of perioperative mortality. The NMDS has nearly complete coverage of publically funded procedures and coverage of a number of privately funded procedures. While this dataset does not have all privately funded events, this is improving. The NMDS does not include day stay procedures. The NMC has nearly complete coverage of mortality linked by the NHI. The coding rules associated with ascribing underlying cause of death, however, are problematic to use to determine the immediate reason for the death. These datasets do not, and are not intended to, describe circumstantial and systems issues that led to the death, hence the need for the collection of contextual data.

There are further national collections that the Committee will investigate in subsequent reports, including the Medical Warning System, the Programme for the Integration of Mental Health Data (PRIMHD) and the New Zealand Cancer Registry. ACC and HDC data could also provide useful context for future reviews.

New Zealand Cancer Registry

This database (established in 1948) provides a population-based tumour registry to collect and store cancer incidence data.

Medical Warning System

This system (established in 1977) warns health care providers of known risk factors that may be important when making clinical decisions about patient care. Classification codes are not validated and this dataset is typically accessed for a description of drug reactions. Content maintenance is primarily the responsibility of health care providers.

Programme for the Integration of Mental Health Data

This database (established in 2008) is the single national mental health and addiction information collection. The data comes from DHBs and NGOs and is stored by the Ministry of Health. Information contained in this dataset includes what services are being provided, who is providing the services, and what outcomes are being achieved.

Endoscopy Working Group

Currently, little is known about endoscopy-related mortality at the national level in New Zealand. As previously discussed, while using the NMDS and the NMC as a starting point for understanding the picture nationally, the reason for admission or the procedure itself may be of less relevance than, for instance, postoperative complications.

Specific case review is an important component of understanding perioperative mortality. A working group has been formed to investigate endoscopy-related mortality in particular. The group is chaired by David Theobald, Clinical Director of the National Endoscopy Quality Improvement Programme (NEQIP). Its members are Jenni Masters, Sector Implementation Director (NEQIP); Campbell White, gastroenterologist; and three members of the Committee (Leona Wilson, Jonathan Koea and Phil Hider).

The purpose of this group is to consider gastrointestinal endoscopy-related mortality and morbidity. Endoscopy related mortality and morbidity includes any death that occurred after an endoscopic procedure (for example, but not exclusively: gastroscopy, colonoscopy, endoscopic retrograde cholangiopancreatography) within 30 days or after 30 days but before discharge from hospital to home or a rehabilitation facility. There is obvious alignment with the Committee's scope.

Cases have been drawn from the NNPAC for 2011. There were 135 cases identified as potentially following an endoscopy. Given the challenges in identifying cases of interest from such a dataset, however, the group selected a sub-set of these from which to conduct an in-depth case review.

Of the 135 cases, 26 were selected with one subsequently being excluded. Clinical notes have been requested for 25 cases across seven DHBs. Notes will be reviewed for up to one year preceding the date of death of the patient.

The group aims to review these cases over the coming year to determine if any of these deaths can be attributed to endoscopy and, if so, what system improvements can be recommended.

Composite case study

Health practitioners have frequently cited the effectiveness of case studies in learning about patient care along the perioperative journey. The following is a hypothetical case study that was presented at the first workshop of the Committee. It highlights the management of a complex patient.

An 84-year-old male presented for a sigmoid colectomy for imminent obstruction of a left colonic adenocarcinoma. He was not in great health. He had come to New Zealand 15 years ago to be with his children and had multiple admissions for worsening chronic obstructive pulmonary disease from smoking. He had an exacerbation of breathlessness and wheeze needing non-invasive ventilation 12 months ago, but was at that time not considered appropriate for intermittent positive pressure ventilation. He did not go to his GP regularly, but after a prolonged period of chest pain he went to see a locum who undertook an electrocardiogram which showed a new anterior ST elevation myocardial infarction. This was four months ago. He underwent a percutaneous coronary intervention and had a drug-eluting stent placed. Other medical issues included atrial fibrillation (five years), type 2 diabetes mellitus, increased body mass index and mid renal impairment.

He was prescribed prednisone, enalapril, spironolactone, salbutamol and serevent inhalers, glipizide and newly started on insulin. He disliked medications and occasionally forgot to take them. He continued to smoke five-plus a day.

Socially he lived with his wife, who was well, and two daughters. He was always accompanied by a family member who acted as a translator. He was able to go to the shops, walked 200 m before stopping from shortness of breath and was independent of activities of daily living. He spent most of his day sitting in the front room but greatly enjoyed his family around him. In total he had 5 children and 10 grandchildren who all lived locally and with whom he kept frequent daily contact.

Case flow

Preoperative consult with Mr S and the youngest daughter: Issues with risk-benefit for surgery discussed. Family informed of an estimated 5 percent mortality rate. Put on list for two weeks.

Discussion points:

- communication challenges
- significance of cultural and social factors in procedure planning
- inconsistencies in defining degree of perioperative risk
- lack of consideration of non-operative interventions.

Day of surgery. Mr S added to operating list due to late cancellation. Surgeon was going on leave for six weeks and other family members had flown in for surgery. Electronic notes down in hospital. Junior anaesthetist keen to defer due to new cardiac murmur but felt that needed to proceed with pressure from surgical team and family. General anaesthesia – difficult epidural – abandoned as taking time and consultant surgeon wanting to avoid cancelling other patients on his list. Long 5 hour operation requiring 6 unit blood transfusion. Intensive Care Unit (ICU) consultant asked to review in OR – *'only for limited care – no renal replacement therapy or intermittent positive pressure ventilation'.* End of case temp 35.7 degrees centigrade, on drugs to support low blood pressure (inotropes), High Dependency Unit admission approved.

Discussion points:

- the allocation of medical staff for more complex procedures and interaction between staff of different grades
- hospital organisation and allocation of resources
- timing of intensive care review and rationale for limiting ongoing therapy
- management of conflict of medical goals between staff and family.

ICU. Family concerned at outcome. ICU staff busy. Admitted after being woken up (post extubation), poor pain relief, and borderline oxygenation. Family distressed and want family meeting. Request intermittent positive pressure ventilation – refused. Major trauma occurs and ICU beds need to be cleared. Patient transferred to ward at 02.00, less than 12 hours after admission.

Discussion points:

- challenge of nursing interface with family
- issues of differences of management plans in the same unit by different clinicians
- allocation of resources in a limited health care environment
- logistics of transferring patients to a general ward out of hours
- challenges of ongoing communication.

Surgical ward. Fluid overload, respiratory distress. Reviewed by house officer. Given frusemide – hypotension – hyperkalaemia + high creatinine – cardiac arrest in front of family 24 hours later. Nurses refuse to undertake CPR due to not-for-resuscitation order – family disagree. Patient dies.

Discussion points:

- management of acutely ill patients on a general surgical ward
- issues of junior medical staff on ward and difficulty in diagnosing complex medical condition
- understanding and implementation of not-for-resuscitation orders

- importance of documentation in case notes.

New coroner. Requests post-mortem. Family distraught – request body but delayed. Complaint to HDC.

Discussion points:

- importance of aligning statutory and cultural goals
- ongoing communication
- adequate, timely and accurate documentation.

Recommendations and next steps

The Committee's work programme is now well established. The next phase will focus on implementing a data collection system that is integrated with existing and established systems, furthering perioperative mortality case review, potentially building on root cause analyses already conducted at health facility level, and tracking perioperative mortality rates to further improve our understanding of the New Zealand context. This understanding will lead to addressing systems issues that will improve the quality and safety of the perioperative journey and outcomes for patients.

The following recommendations are informed by this progress report and the preliminary findings of perioperative mortality data for 2007–2011:

The Committee recommends for *improving perioperative care* that:

- optimal care pathways are evaluated in the context of assessing mortality following acute surgery for those aged over 80 years
- a continuing focus on promotion of formal preoperative assessment for the risk of venous thromboembolism is warranted given the apparent minor increase in pulmonary embolism mortality (7.6 per 100,000 elective, 2006–2010; 8.7 per 100,000, 2007–2011).

The Committee recommends for *system development* that:

- standardised perioperative mortality reporting is promoted to, and further developed with, a sample of District Health Boards and private facilities
- further piloting of a perioperative mortality review database occurs at the health care facility level
- stage two of piloting commences, involving both *internal* and *external* peer review of the proposed data fields with modification as necessary.

The Committee recommends for *further analysis* that:

- the proposed WHO Patient Safety Programme's standardised public health metrics for surgical care are incorporated into perioperative mortality analysis and reporting
- the standard out-of-hospital death notification process be explored as a mechanism to identify deaths that occurred within 30 days of an operative procedure and after discharge
- the Commission considers developing a resource on Hospital Standardised Mortality Ratios.

When collecting perioperative mortality data to enhance existing datasets, work will continue to operate under the following premises:

- **All review takes place in a no-blame culture**. The emphasis is on addressing system issues and quality improvements rather than individual blame.
- **Review is multidisciplinary**. This reinforces a review of the system rather than individual specialities or parts of service and provides holistic review.
- **Local quality activities are key to the success of this process**. Many local systems have already developed at the health facility level to review mortality, especially root cause analysis.
- **Administrative burden is managed appropriately.** While the forms being assessed are detailed, they will be refined and the final process built in a way to minimise the administrative component.
- **Linkage to national data sets is mandatory**. These data can be enhanced when linked with local contextual data.

The details of the preliminary results of perioperative mortality for 2007–2011 presented in this progress report will be fully reported at the annual workshop of the Committee in June 2014.

Appendix 1: Integrated forms (overleaf)

1. Surgeon or proceduralist case review form
2. Anaesthetist case review form
3. Nurse or allied health care review form

Surgeon or Proceduralist Case Report Form

To be completed by clinician performing procedure, or surgeon responsible for the patient

Patient details					
NHI	AAANNNN	Sex	M/F/U/I	birthdate	dd-mm-yyyy
ethnicity 1	NN	ethnicity 2	NN	ethnicity 3	NN
Domicile	NNNN	DHB of domicile	NNN	Facility	NNNN
Date of last admission	dd-mm-yyyy	Date of last procedure	dd-mm-yyyy	Date of discharge	dd-mm-yyyy
Date of death	dd-mm-yyyy				

General			
Case reporter speciality	1 = General 2 = Vascular 3 = Urology 4 = Neurosurgery 5 = Orthopaedics 6 = ORL, head & neck 7 = Ophthalmology 8 = Paediatrics 9 = Obstetrics & Gynaecology 10 = Plastic 11 = Oral / Maxillofacial 12 = Cardiothoracic 13 = Dentist 14 Other (specify)	Grade of reporter	1 = Consultant 2 = Advanced Surgical Trainee 3 = Service Registrar 4 = Basic Surgical Trainee 5 = GP Surgeon 6 = Other (specify)

The following text fields allow the case to be put in context. Note that all data collection is anonymised - please use people's roles rather than their names in the narrative. Differentiate by letter if needed: "registrar A, registrar B…"

Please describe the main diagnosis that led to the last event. Note the pre-operation diagnosis and final post-operation diagnosis if they differ. Note your role in the care - eg admitting surgeon.

Text:

Please describe the the most important procedure ("index" procedure) in the last episode of care, and circumstances surrounding that. Note if earlier procedures had a bearing on the case, and if the planned procedure was changed after the commencement of the procedure:

Index procedure:

Text:

Please describe the circumstances, location and sequence of events leading to death where known. If known state the final cause of death (including post-mortem findings if relevant)

Text:

Did you complete the death certificate? Y/N

Pre-op					
ASA level (1-5) prior to any surgery	1. A normal healthy patient 2. With mild systemic disease 3. With severe systemic disease which limits activity but is not incapacitating 4. With incapacitating systemic disease that is a constant threat to life 5. A moribund patient who is not expected to survive with or without an operation	reporter's view (prior to any surgery) of overall risk of death	1. Minimal 2. Small 3. Moderate 4. Considerable 5. Expected	BMI	<18.5 >18.5-25 >25-30 (Overweight) Above 30 (Mildly Obese) Above 35 (Obese) Above 40 (Morbidly Obese) Above 50 (Super Obese) NK Unknown
Regular smoker prior to last admission	Y/N/DK	Serum albumin g/L	NN/not performed/NK	Palliative care patient?	Y/N/DK

Co-existing morbidity and risk factors:					
Cardiovascular	☐	Sepsis	☐	IV drug user	☐
Renal	☐	Major burns	☐	Alcohol use	☐
Respiratory	☐	Major trauma	☐	Pregnancy	☐
Diabetes	☐	Unconscious	☐	On dialysis	☐
Malignancy	☐	Anaemia	☐	Frailty/age	☐
Other (specify)					

Could pre-operative assessment and management have been improved for this patient:			
Care prior to admission	Y/N/NA	Referral promptness	Y/N/NA
Referral documentation	Y/N/NA	Referral/transportation support	Y/N/NA
Triage and assessment	Y/N/NA	Diagnostic workup	Y/N/NA
Decisions on DVT prophylaxis	Y/N/NA	Decision on the use of antibiotics	Y/N/NA
Fluid balance, blood volume	Y/N/NA	Nutritional status assessment	Y/N/NA
Anaesthetic pre-assessment	Y/N/NA	Theatre availability	Y/N/NA
Staff availability	Y/N/NA	Staff type/grade availabilty	Y/N/NA
Facility capacity	Y/N/NA	time from admission to procedure	Y/N/NA

An area for consideration is where the clinician believes areas of care COULD have been IMPROVED or DIFFERENT, but recognises that it may be an area of debate.

An area of concern is where the clinician believes that areas of care SHOULD have been better.

An adverse event is an unintended injury caused by medical management rather than by disease process, which is sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributes to or causes death.

Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the pre-operative care of this patient - **Y/N** If Yes:

Please describe the most significant event:	

Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action** **Other (please specify)**	

Procedure *Concentrating on the index procedure undergone by the patient being reported*

Timing of procedure post admission	**Elective** **<2 hrs** **2-24 hrs** **>24 hrs post-admission**	Date Hour of Day	**dd/mm/yyyy** **0800-1800** **>1800-2200** **>2200-0759** **DK**	Anaesthesia used	**General** **Regional (neuroaxial)** **Regional (Peripheral)** **Local** **Sedation** **None**
Length of procedure	**mins**	Location of procedure	**Operating theatre** **Procedure room** **Endoscopy suite** **Other (specify)**	Anaesthetist present	**Y/N**
Proceduralist speciality	**1 = General** **2 = Vascular** **3 = Urology** **4 = Neurosurgery** **5 = Orthopaedics** **6 = ORL, head & neck** **7 = Ophthalmology** **8 = Paediatrics** **9 = Obstetrics & Gynaecology** **10 = Plastic** **11 = Oral / Maxillofacial** **12 = Cardiothoracic** **13 = Dentist** **14 Other (specify)**		Grade of most senior person undertaking procedure	**1 = Consultant** **2 = Advanced Surgical Trainee** **3 = Service Registrar** **4 = Basic Surgical Trainee** **5 = GP Surgeon** **6 = Nurse** **7 = Other (specify)** If 2-4 selected; Was Consultant present in room **Y/N** If No, was Consultant within 5 minutes call **Y/N/DK**	
Operation checklist used?		**Y/N/NA/DK**			

Could operative care and management have been improved for this patient:

Decision to operate at all?		**Y/N/NA**	Choice of procedure		**Y/N/NA**
Timing of procedure		**Y/N/NA**	Location of procedure		**Y/N/NA**
Equipment availability		**Y/N/NA**	Operation checklist		**Y/N/NA**
Staff availability		**Y/N/NA**	Staff type/grade availabilty		**Y/N/NA**
Staff punctuality		**Y/N/NA**	Time from patient arrival at location		**Y/N/NA**
Technical management of surgery		**Y/N/NA**	Blood loss control		**Y/N/NA**

Intra-operative complications

Cardiac arrest	☐	Desaturation	☐	Blood transfusion	☐
Hypotension	☐	Contamination	☐	Other organ injury	☐
Anaesthesia event	☐	Needle stick inj	☐	Missed swab	☐
Other (specify)					

Was the procedure abandoned on finding a terminal situation?	**Y/N**	Did the patient die during the course of the procedure?	**Y/N**

Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the operative care of this patient (for any procedure in the last episode) - **Y/N** If Yes:

Please describe the most significant event:	

Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action** **Other (please specify)**	

Post-operative	*Following the last principal procedure undergone by the patient*				
Ventilated post-op?	Y/N/NA	ICU/HDU used in immediate post-operative care?	Y/N/NA	If No, was there an unplanned admission to ICU/HDU?	Y/N/NA
Could post-operative care and management have been improved for this patient:					
Fluid balance/blood volume		Y/N/NA	DVT prophylaxis		Y/N/NA
Mobilisation		Y/N/NA	Nutrition		Y/N/NA
Wound management		Y/N/NA	Investigations/monitoring		Y/N/NA
Equipment availability		Y/N/NA	Staff type/grade availabilty		Y/N/NA
Staff availability		Y/N/NA	Staff teamwork		Y/N/NA
Care transfer		Y/N/NA	Care after discharge from facility		Y/N/NA
Post-operative complications:					
Wound infection	☐	Pneumonia	☐	Bleeding	☐
Wound breakdown	☐	Septicaemia	☐	DVT	☐
Anastamosis leak	☐	UTI	☐	Embolism	☐
Cardiac event	☐	Renal failure	☐	Fall	☐
Other (specify)					
Unplanned return to theatre? Y/N If Yes, why?					
Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the post-operative care of this patient - Y/N If Yes:					
Please describe the most significant event:					
Area of:	Consideration Concern Adverse Event		Which:	Made no difference to outcome May have contributed to death Caused death of patient who would otherwise be expected to survive	
Was the event preventable?	Definitely Probably Probably not Definitely not		Associated with?	Organisational policies and procedures Resourcing Staff error Patient action Other (please specify)	

Overall					
Was ICU/HDU used at any time in this episode of care?		Y/N/NA	Would the patient have benefited from having some/more ICU/HDU care?		Probably/Possibly/Unlikely
If probably/possibly, note why ICU/HDU not used					
Did organisational difficulties, policy, or procedures contribute to any issues found?					Y/N/NA
If Yes, specify					
Did teamwork or communication difficulties contribute to any issues found?					Y/N/NA
If Yes, specify					
Taking all things into consideration, did the surgical care in this case contribute to the death?	1. Reasonably certain caused 2. Probably contributed 3. May have contributed 4. Probably not related 5. Definitely not related 6. Unable to tell with current data 7. Inadequate data		Taking all things into consideration, did the overall care in this case contribute to the death?	1. Reasonably certain caused 2. Probably contributed 3. May have contributed 4. Probably not related 5. Definitely not related 6. Unable to tell with current data 7. Inadequate data	
In retrospect, would you have done anything differently?					Y/N
If yes specify:					
Has this case been reviewed previously?					Y/N/NA/DK
If Yes, specify; note actions resulting/pending:					
Would further review of this case be useful - eg Root Cause Analysis					Y/N/NA/DK
Any other comments?					
Any comments on this form, or suggestions for improvement for the peri-operative mortality review programme?					

If answered Y to question 18a	
Death Certificate - Causes of death	
Part I. (a) Direct cause: The disease, injury or complication directly leading to death	Approximate time between onset and death
(b) Antecedent causes: Morbid conditions (if any) giving rise to the above cause	
(c) The underlying condition	
Part II. Other significant conditions contributing to death, but not related to the disease or condition causing it	

Anaesthetist Case report Form

To be completed by clinician performing anaesthesia for procedure, or otherwise responsible for the patient

Patient details

NHI	AAANNNN	Sex	M/F/U/I	birthdate	dd-mm-yyyy
ethnicity 1	NN	ethnicity 2	NN	ethnicity 3	NN
Domicile	NNNN	DHB of domicile	NNN	Facility	NNNN
Date of last admission	dd-mm-yyyy	Date of last procedure	dd-mm-yyyy	Date of discharge	dd-mm-yyyy
Date of death	dd-mm-yyyy				

General

Grade of reporter	Specialist Anaesthetist Non-specialist Anaesthetist Post fellowship trainee Trainee year 3-4+ Trainee year 1-2 General practitioner Other (specify):	Relationship of reporter to case anaesthetist	Same person Supervisor Other (specify)

The following text field allows the case to be put in context. Note that all data collection is anonymised - please use people's roles rather than their names in the narrative. Differentiate by letter if needed: "registrar A, registrar B…"

Please briefly describe the case and the anaesthetic approach, and details around the circumstances, location and sequence of events leading to death where known:

Pre-op

ASA level (1-5) prior to any surgery	1. A normal healthy patient 2. With mild systemic disease 3. With severe systemic disease which limits activity but is not incapacitating 4. With incapacitating systemic disease that is a constant threat to life 5. A moribund patient who is not expected to survive with or without an operation	BMI	<18.5 >18.5-25 >25-30 (Overweight) Above 30 (Mildly Obese) Above 35 (Obese) Above 40 (Morbidly Obese) Above 50 (Super Obese) NK Unknown

Regular smoker prior to last admission	Y/N/DK	Anaesthetic pre-operative assessment performed?	Y/N/DK	If Yes, performed by:	Anaesthetist performing procedure Other anaesthetist trainee anaesthetist Other - specify
Pre-operative assessment adequate?	Y/N/NA	If No, specify			

Co-existing morbidity and risk factors:

Cardiovascular	☐	Sepsis	☐	IV drug user	☐
Renal	☐	Major burns	☐	Alcohol use	☐
Respiratory	☐	Major trauma	☐	Pregnancy	☐
Diabetes	☐	Unconscious	☐	On dialysis	☐
Malignancy	☐	Anaemia	☐	Bed-bound	☐
Other (specify)					

Could pre-operative assessment and management have been improved for this patient:

Care prior to admission	Y/N/NA	Referral promptness	Y/N/NA
Referral/case documentation	Y/N/NA	Referral/transportation support	Y/N/NA
Pre-operative lab tests carried out	Y/N/NA	Pre-operative radiology carried out	Y/N/NA
Decisions on DVT prophylaxis	Y/N/NA	Decisions on the use of pre-meds	Y/N/NA
Fluid balance, blood volume	Y/N/NA	Stomach contents assessment	Y/N/NA
Theatre/procedure room type/availability	Y/N/NA	Equipment availability	Y/N/NA
Staff availability	Y/N/NA	Staff type/grade availabilty	Y/N/NA
Patient condition prior to procedure	Y/N/NA	ICU/HDU support	Y/N/NA

An area for consideration is where the clinician believes areas of care COULD have been IMPROVED or DIFFERENT, but recognises that it may be an area of debate.

An area of concern is where the clinician believes that areas of care SHOULD have been better.

An adverse event is an unintended injury caused by medical management rather than by disease process, which is sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributes to or causes death.

Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the pre-operative care of this patient - **Y/N** If Yes:

Please describe the most significant event:	

Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action** **Other (please specify)**	

Procedure	*Concentrating on the last procedure undergone by the patient being reported*				
Timing of procedure post admission	**Elective** **<2 hrs** **2-24 hrs** **>24 hrs post-admission**	Hour of Day	**0800-1800** **>1800-2200** **>2200-0759** **DK**	Anaesthesia technique used (1 or more)	**General** **Regional (neuroaxial)** **Regional (Peripheral)** **Regional (intravenous)** **Local** **Sedation** **None**
Length of anaesthesia	**mins**	Type of ventilation	**Spontaneous** **CPAP** **SIMV** **IPPV** **PEEP** **Other - specify**	Additional technique (1 or more)	**ECMO** **Balloon pump** **Central line** **Resusitation prior to anaesthesia**
Grade of anaesthetist covering last procedure	**Specialist Anaesthetist** **Non-specialist Anaesthetist** **Post fellowship trainee** **Trainee year 3-4+** **Trainee year 1-2** **General practitioner** **Other (specify):**		If Trainee selected:	Was Consultant present in room **Y/N** If No, was Consultant within 5 minutes call **Y/N/DK**	

Operation checklist used?		**Y/N/NA/DK**			
Could anaesthetic care and management have been improved for this patient in the following areas:					
Choice of technique		**Y/N/NA**	Induction method/drugs used		**Y/N/NA**
Maintenance method/drugs used		**Y/N/NA**	Reversal method/drugs used		**Y/N/NA**
Other medication use - steroids, insulin…		**Y/N/NA**	Airways/ventilation management		**Y/N/NA**
Staff availability		**Y/N/NA**	Equipment availability		**Y/N/NA**
Technician availability		**Y/N/NA**	Theatre availability		**Y/N/NA**
Op list/theatre management		**Y/N/NA**	Anaesthetist hours worked that day		**Y/N/NA**
Communication/teamwork		**Y/N/NA**	Blood volume management		**Y/N/NA**
Intra-operative complications:					
Cardiac arrest	☐	Intubation delays	☐	Convulsion	☐
Arrythmia	☐	Hypoxia/airways	☐	Regurgitation	☐
Hypertension	☐	Level consciousne	☐	Equipment fault	☐
Other (specify)					
Was the procedure curtailed due to anaesthetic support complications?		**Y/N**	Did the patient die during the course of the procedure?		**Y/N**

Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the operative care of this patient - **Y/N** If Yes:

Please describe the most significant event:	

Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action** **Other (please specify)**	

Post-operative	*Following the last procedure undergone by the patient*				
Location of immediate post-operative care?	**Recovery room** **ICU/HDU** **Ward** **Other hospital** **Other - specify**	Ventilated post-op?	**Y/N/NA**	ICU/HDU used in post-operative care?	**Y/N/NA**
If N, would patient have benefited from having ICU/HDU care?		**Y/N**	If Yes, specify		
Could post-operative care and management have been improved for this patient:					
Fluid balance		**Y/N/NA**	DVT prophylaxis		**Y/N/NA**
Mobilisation		**Y/N/NA**	Nutrition		**Y/N/NA**
Wound management		**Y/N/NA**	Investigations/monitoring		**Y/N/NA**
Equipment availability		**Y/N/NA**	Staff type/grade availabilty		**Y/N/NA**
Staff availability		**Y/N/NA**	Staff teamwork		**Y/N/NA**
Care transfer		**Y/N/NA**	Care after discharge from facility		**Y/N/NA**
Post-operative complications					
Hypoxia	☐	Fitting	☐	Febrile	☐
Airways obstruction	☐	Prolonged unconsciousness	☐	Regurgitation	☐
Other (specify)					
Unplanned return to theatre? **Y/N** If Yes, why?					
Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the post-operative care of this patient - **Y/N** If Yes:					
Please describe the most significant event:					
Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action** **Other (please specify)**	
Overall					
Did organisational difficulties, policy, or procedures contribute to any issues found?					**Y/N/NA**
If Yes, specify					
Did teamwork or communication difficulties contribute to any issues found?					**Y/N/NA**
If Yes, specify					
Taking all things into consideration, did anaesthetic care in this case contribute to the death?	**1. Reasonably certain caused** **2. Probably contributed** **3. May have contributed** **4. Probably not related** **5. Definitely not related** **6. Unable to tell with current data** **7. Inadequate data**		In retrospect, would you have done anything differently?		**Y/N** If yes specify:
Has this case been reviewed previously?					**Y/N/NA/DK**
If Yes, specify; note actions resulting/pending:					
Would further review of this case be useful - eg Root Cause Analysis					**Y/N/NA/DK**
Any other comments?					
Any comments on this form, or suggestions for improvement for the peri-operative mortality review programme?					

Nursing or Allied Health Case report Form					
To be completed by a nurse or allied health/technical staff member involved in or supervising the care of the patient					
Patient details					
NHI	AAANNNN	Sex	M/F/U/I	birthdate	dd-mm-yyyy
ethnicity 1	NN	ethnicity 2	NN	ethnicity 3	NN
Domicile	NNNN	DHB of domicile	NNN	Facility	NNNN
Date of last admission	dd-mm-yyyy	Date of last procedure	dd-mm-yyyy	Date of discharge	dd-mm-yyyy
Date of death	dd-mm-yyyy				
General					
Job title (eg Charge Nurse, Senior theatre nurse, Senior physiotherapist)			Care setting	Ward Theatre Intensive care Supervisor Other - specify	
Patient nursing acuity prior to procedure	Critical High risk: Time critical (HRTC) Stable Minor Unknown	If Critical/HRTC specify why:			
Palliative care patient?	Y/N/DK	Do Not Resusitate order in place?	Y/N/DK		
Patient care					
Could organisational and management factors have been improved for the care of this patient?					
Organisational arrangement of staff	Y/N/NA		Adequate numbers of staff	Y/N/NA	
Adequate access to senior clinical staff	Y/N/NA		Staff type/grade availabilty	Y/N/NA	
Equipment availability	Y/N/NA		Equipment design adequate for purpose	Y/N/NA	
Access to documentation - paper, electronic	Y/N/NA		Access to investigation results	Y/N/NA	
Work area/environment adequacy	Y/N/NA		Hours worked on shift	Y/N/NA	
Policies and procedures known, accessible	Y/N/NA		Staff role delineation clarity	Y/N/NA	
If any Y, or any other reason, specify:					
Could patient factors have been managed better for this patient?					
Observations were timely	Y/N/NA		Abnormal results recognised and acted on	Y/N/NA	
Abnormal results acted upon in a timely way	Y/N/NA		Condition seriousness recognised	Y/N/NA	
Patient informed throughout	Y/N/NA		Family/whanau informed throughout	Y/N/NA	
Cultural barriers recognised and managed	Y/N/NA		Social barriers recognised and managed	Y/N/NA	
If any Y, or any other reason, specify:					
Could teamwork/training factors have been managed better for this patient?					
Information sharing	Y/N/NA		Clear management plan	Y/N/NA	
Communication between team members	Y/N/NA		Team consistency - usually work together?	Y/N/NA	
Adequate training	Y/N/NA		Adequate experience	Y/N/NA	
Nursing/AH concerns were responded to	Y/N/NA		Staff punctuality	Y/N/NA	
If any Y, or any other reason, specify:					
Medicine reconciliation performed	Y/N/NA/DK		Operation checklist used	Y/N/NA/DK	
Care complications:					
Wound infection	☐	Pneumonia	☐	Bleeding	☐
Wound breakdown	☐	Septicaemia	☐	DVT	☐
Pressure sore	☐	UTI	☐	Embolism	☐
IV/drain site infection	☐	Medication error*	☐	Fall	☐
If any checked - specify circumstances:					
*If medication error is checked, type of medication error		wrong dose wrong medication omitted dose other - specifiy			

Area of concern					
An area for consideration is where the clinician believes areas of care COULD have been IMPROVED or DIFFERENT, but recognises that it may be an area of debate.					
An area of concern is where the clinician believes that areas of care SHOULD have been better.					
An adverse event is an unintended injury caused by medical management rather than by disease process, which is sufficiently serious to lead to prolonged hospitalisation or to temporary or permanent impairment or disability of the patient at the time of discharge, or which contributes to or causes death.					
Considering the above and any other factors, were there Areas for Consideration, Areas for Concern, or Adverse Events in the overall care of this patient - **Y/N** If Yes:					
Please describe the most significant event:					
Area of:	**Consideration** **Concern** **Adverse Event**		Which:	**Made no difference to outcome** **May have contributed to death** **Caused death of patient who would otherwise be expected to survive**	
Was the event preventable?	**Definitely** **Probably** **Probably not** **Definitely not**		Associated with?	**Organisational policies and procedures** **Resourcing** **Staff error** **Patient action**	
Overall					
Was there a cardiac arrest event in the course of care for this patient?		**Y/N/NA**		If Yes, outcome:	**Successful (ie died subsequently)** **Unsuccessful**
If Yes:	Location:	**Ward** **Theatre** **Emergency Department** **Other - specify**		Cardiac massage:	**External** **Open** **None** **Unknown**
Adequate resuscitation equipment available		**Y/N/NA/DK**	Timely arrival of team		**Y/N/NA/DK**
Adequate team members available		**Y/N/NA/DK**	Adequate training of team		**Y/N/NA/DK**
Defibrillator available		**Y/N/NA/DK**	Adequate monitoring/warning		**Y/N/NA/DK**
If any Y, or other concerns, specify:					
Taking all things into consideration, did the nursing/allied health care in this case contribute to the death?	**1. Reasonably certain caused** **2. Probably contributed** **3. May have contributed** **4. Probably not related** **5. Definitely not related** **6. Unable to tell with current data** **7. Inadequate data**		In retrospect, would you have done anything differently?		**Y/N**
If yes specify:					
Has this case been reviewed previously?					**Y/N/NA/DK**
If Yes, specify; note actions resulting/pending:					
Would further review of this case be useful - eg Root Cause Analysis					**Y/N/NA/DK**
Any other comments?					
Any comments on this form, or suggestions for improvement for the peri-operative mortality review programme?					

Appendix 2: Thirty-day mortality rates in New Zealand resident population

Table 9: Thirty-day mortality rates for New Zealand resident population

Age groups (5-year blocks)[1]	Male 30-day mortality/100,000	Female 30-day mortality/100,000
0	44.88	36.00
1	2.38	1.89
5	0.58	0.66
10	1.40	1.15
15	6.25	2.71
20	7.40	3.04
25	6.00	3.53
30	8.14	4.27
35	9.53	5.92
40	13.81	9.29
45	19.48	13.97
50	29.75	21.04
55	46.60	30.16
60	70.60	49.07
65	117.29	81.12
70	191.34	129.04
75	332.14	215.10
80	581.51	415.73
85	1011.37	801.21
90	1841.84	1722.66

[1] The age interval relates to a 5-year period except for: age 0 which relates to a 1-year period, age 1 which relates to a 4-year period, and age 90 which relates to remaining life span.

Based on Statistics New Zealand Life Tables 2009–2011

List of abbreviations

ACC	Accident Compensation Corporation
ACHI	Australian Classification of Health Interventions
ANZCA	Australian and New Zealand College of Anaesthetists
ASA	American Society of Anesthesiologists
CMS	Coroner's Case Management System
HDC	Health and Disability Commission
ICU	Intensive Care Unit
NEQIP	National Endoscopy Quality Improvement Programme
NHI	National Health Index
NMC	National Mortality Collection
NMDS	National Minimum Dataset
NNPAC	National Non-Admitted Patient Collection
POMRC	Perioperative Mortality Review Committee
PRIMHD	Programme for the Integration of Mental Health Data
RACS	Royal Australasian College of Surgeons
RANZCOG	Royal Australasian College of Obstetricians and Gynaecologists
WHO	World Health Organization

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