

# The Hidden Pandemic of Post-Operative Complications

- A Discussion Paper



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## Summary

Although surgery is, and is likely to remain, one of the mainstays of healthcare, it is recognised that postoperative complications are common, and adversely impact many groups, including patients and families; clinicians; healthcare institutions; fund holders; and employers. Based on projected population changes over the next thirty years, we can expect these impacts to increase substantially.

Complications fall into different groups, but non-procedural ('medical') issues related to the physiological insult of surgery and anaesthesia are the prime focus of the growing field of perioperative care, or perioperative medicine (POM). Specific management and treatment options are multiple, and broadly relate to preparation for surgery, intraoperative care, and recovery and return to optimal functioning.

These specific medical and allied health interventions have evolved over time, and often been added to standard care pathways and processes. However, it is increasingly recognised in organisational and medical analysis that repeated 'patches' are usually inadequate to address quality and sustainability when there are major shifts in the industry, and these shifts are now evident in surgery and perioperative care.

Systems thinking and systems redesign underpins sustainable high quality performance and improvement in the presence of such shifts. Systems must include identification of current best practices, and the capacity and processes needed to deliver these consistently and reliably. Critical to such a systems approach is identification of relevant, practical, measurable outcomes and goals, linked to mechanisms for ongoing learning and quality improvement. Quality in healthcare relates to the broader STEEEP™ principles of safe, timely, effective, efficient, equitable and patient-centred care.

Substantial work has been undertaken within Australia and overseas on what elements might constitute a high functioning system to manage the increasing risk postoperative complications.

This Summit will consider the nature and scope of the quality and sustainability challenge, the principles which should underlie a high-quality systems approach, what elements and processes are required to deliver a solution, and how this could be implemented.

There is an opportunity to collectively determine a strategic and implementation plan, to provide jurisdictions throughout Australia with guidance and options on how to deliver sustainable best practice care.

## The Hidden Pandemic

Surgery is, and is likely to remain, one of the mainstays of medical care. It is estimated that one third of the global burden of disease is amenable to surgery, while two thirds of patients suffering trauma or a cancer diagnosis require surgery. Given the aging population and increase in cancer burden it is estimated that surgical services will need to double in capacity worldwide over the next 20 years.<sup>1</sup> Inability to deliver essential surgical services accounts for 17% loss in GDP, which in itself creates a dilemma for poorer countries who cannot deliver such services with dire consequences on the socioeconomic status of their populations.

Major postoperative complications are common, occurring in around 20% of patients,<sup>2,3</sup> and the risk increases with factors such as surgery type, and patient co-morbidities and age. In practice, many serious complications may go unrecorded.<sup>4</sup>

These complications have clear sequelae, in terms of events of direct importance to patients and their lives, such as length of hospital stay and re-admissions,<sup>5,6</sup> and days at home after surgery (now a recognised indicator of quality of care).<sup>7</sup> Patients suffering postoperative complications also have poorer long-term survival, which in cancer patients may relate to inability to access timely adjuvant chemoradiotherapy after surgery. Further, these events have direct relevance to healthcare costs (with two to seven fold increase in healthcare cost in patients that suffer 2 or 3 postoperative complications, respectively) and hence overall healthcare sustainability.<sup>8</sup>

Recent estimations, based on the population changes predicted for Australia, including ageing and associated chronic disease, suggest that with no changes to current practice, complications and their sequelae will increase in frequency at around 10% per year.<sup>9</sup> This has been termed “the hidden pandemic of postoperative complications”, based on predicted growth and frequent under-estimation.<sup>10</sup> This pandemic is not inevitable. It is clear from large data sets that there is substantial inter-practitioner and inter-institutional variation in clinical performance, suggesting significant opportunities for improvement.<sup>8,3,11,12</sup> Furthermore, many patients present with modifiable risk factors that can be optimised before surgery (prehabilitation).

This is the problem we are trying to solve.

## Foundations for solutions

### *Defining complications*

Post-operative complications can be classified as procedure-specific or non-surgical complications. Non-surgical complications are the focus of this meeting.

**Procedure-specific** complications are mostly related to the initial operative goals of the surgery (e.g. removal of mass, anastomosis, successful implantation of a device) and may be early or delayed (e.g. implant failure, disease recurrence). These are usually technical and skill-based in nature which means the influence of 'non-surgical' management on these complications is modest.

**Non-surgical complications** however, relate to recovery and healing from the physiological insult of surgery and anaesthesia. This extends from immediate recovery through to optimal functioning with societal re-integration. Many of these complications can be prevented or ameliorated through specific non-surgical treatments and care and are the prime intent of the growing field of perioperative medicine (POM). The range of potential complications is large, but those commonly targeted in perioperative medicine are listed in Appendix 1, and seen in risk prediction tools - see Appendix 2.

### *Non-surgical complications – pattern and risk*

Complications follow common patterns of incidence, severity and sequelae. The likely patterns of these can be determined from large databases and modelling. Multiple models exist looking at the impact on risk of patient factors (many of which are modifiable preoperatively) and surgical factors,<sup>14</sup> with varying factor inclusion, outcomes and performance. Systems thinking though has the potential for large gains with awareness of the risks from system factors such as capacity, case volume, structure, expertise and process.<sup>15</sup> One of the larger and better performing models is the risk prediction tool in the American College of Surgeons National Surgical Quality Improvement Program (NSQIP). While NSQIP has a US focus, there is international participation, including seven Australian hospitals (see Appendix 2). This tool includes a specific checkbox on non-surgical options, acknowledging that when a high-risk patient is identified, conservative management options should be considered.

### *Complications, events and consequences*

Specific medical, nursing and allied health responsibilities are often the clinical focus. However, the consequences of post-operative complications affect a wide range of groups within the system and can be broadly grouped into: (i) patient/family/carer-centred; (ii) hospital healthcare-centred; (iii) non-hospital care-centred.

What is measurable, or measured is highly relevant to each group, and may be highly specific. Their use in quality management may be practice- or research-focussed.

Some of the measurable events are outlined in Appendix 3

## *What 'non-surgical' management can reduce the risk, or severity, of complications*

Perioperative medicine has highlighted specific interventions which have the potential to alter complications and outcomes. They fall into:

- pre-operative risk assessment and preparation;
- intra-operative management (e.g. less variability in care - enhanced recovery after surgery; and
- postoperative care (e.g. extended high acuity care into the postoperative period).

Not all apply to all patients, emphasising the importance of timely patient risk- and needs-assessment, and triage to appropriate care.

Levels of evidence for specific interventions vary. Each on its own may have only a small or (scientifically) immeasurable effect, or may be context-specific.<sup>10</sup> They may, however, be additive or synergistic, emphasising the need for a systems approach to ensure sub-optimal care is avoided [Systems; Perioperative Surgical Home (PSH); Centre for Perioperative Care (CPOC)]. Some examples of specific management are outlined in Appendix 4.

## The need for systems thinking

In the UK, a multidisciplinary coordinated approach in perioperative medicine is advocated through the Centre for Perioperative Care (<https://cpoc.org.uk>) –

*“Sharing examples of good practice provides an opportunity for colleagues to review their own pathways in light of the importance of integrated and person-centred care. It will also provide commissioners with the information they need to support the commissioning of high quality care.”*

Similarly, the USA’s Perioperative Surgical Home concept (<https://www.asahq.org/psh>) is

*“a patient-centric, team-based model of care created by leaders within the American Society of Anesthesiologists to help meet the demands of a rapidly approaching health care paradigm that will emphasize gratified providers, improved population health, reduced care costs and satisfied patients.”*

In Europe, with a number of centres participating in Australia, the Enhanced Recovery After Surgery (ERAS) society publishes best practice pathways based on evidence-based medicine and uses an ERAS interactive audit system (EIAS) for institutions to measure compliance rates with best practice pathways and also capture their institutional complication rates (<https://erassociety.org/interactive-audit/>).

In Australia and New Zealand, substantial progress has been made in the development of a multi-disciplinary “effective, integrated and collaborative perioperative care model”. ([http://www.anzca.edu.au/documents/sau\\_bulletin-peri-article\\_20190528.pdf](http://www.anzca.edu.au/documents/sau_bulletin-peri-article_20190528.pdf)). The effectiveness of this model hinges on identification of needs at each step in the patient journey, from initial decision to consider surgery to the return to optimal function, with management options available. See Appendix 5. However, we need to move beyond the multidisciplinary model to a systems approach to avoiding post-operative complications.

Development of mechanisms to address the evolving perioperative challenge has often been incremental, adding layers or elements to conventional processes. A more systems-based approach is likely to solve deeper problems and facilitate more effective and sustainable solutions.

It has been recognised that

*“healthcare systems fail to provide treatments that are known to work, persist in using treatments that don’t work, enforce delays, and tolerate high levels of error. Healthcare leaders are now recognising . . .that the healthcare system needs radical redesigning.... Healthcare redesign can be broadly defined as thinking through from scratch the best process to achieve speedy and effective care from a patient perspective, identifying where delays, unnecessary steps or potential for error are built into the process, and then redesigning the process to remove them and dramatically improve the quality of care.”<sup>16</sup>*

Consistency and reduction in unnecessary variation, are intrinsic to quality outcomes in systems. Identification and management of unwanted variation can be an opportunity for the health system to improve and may reflect one or more of: access inequity, uncertainty around optimal care, evidence gaps, inadequate systems support, and a need for incentivisation.<sup>17,18,19</sup>

A system with a quality focus can be considered as:

*“the organizational structure, responsibilities, procedures, processes and resources for implementing quality management”. It should “define and cover all facets of an organization’s operation, from identifying and meeting the needs and requirements of customers, design, planning, purchasing, manufacturing, packaging, storage, delivery and service, together with all relevant activities carried out within these functions. It deals with organization, responsibilities, procedures and processes. Put simply [it] is good management practice.”<sup>20</sup>*

Importantly, this recognises that a coordinated system as a whole, rather than individual elements, however excellent, maximises output.<sup>10</sup>

Implementation is not without challenges. For example, Enhanced Recovery After Surgery (ERAS) a program been developed in perioperative medicine with the aim to:

*“reduce the patient’s surgical stress response, optimize their physiologic function, and facilitate recovery by incorporating evidence-based interventions into patient management”.<sup>21</sup>*

Yet, despite the compelling evidence in support of ERAS, it has not been adopted widely. Results from a Canadian qualitative study suggest that although clinicians see the value in implementing an ERAS program, lack of nursing staff, lack of financial resources, resistance to change, and poor communication and collaboration are among the barriers to its adoption.<sup>22</sup>

## Value based care

The Baylor STEEEP™ principles (safe, timely, effective, efficient, equitable, patient-centred) emphasise that considering what constitutes high value care (cost V outcome)<sup>22</sup> is intrinsic to quality.

In general, there is a paucity of good evidence regarding high value care in perioperative medicine, with analyses ranging from simple estimates to formal cost-effectiveness calculations. The perspective of return on investment is critical to the creation of true value, as short-term goals may create false economies or cost-shifting. For example, reduced length of stay may be associated with improved care,<sup>24</sup> or create downstream adverse effects on re-admissions and costs.<sup>25</sup>

Some available data do suggest creation of higher value care, especially with systems-based data:

- ERAS: An economic evaluation of the ERAS multisite implementation program for colorectal surgery in Alberta estimated the net health system savings to be \$1768 per patient, or, in terms of return on investment, for every \$1 invested in ERAS, \$3.80 could be expected in return.<sup>26</sup>
- NSQIP (Risk stratification and Benchmarking): This American College of Surgeons National Surgical Quality Improvement Program has a dynamic database that allows risk stratification for each individual patient and also allows institutional benchmarking, with ability to identify areas where institutions are outliers and implement programs to improve care. An introduction of NSQIP into a Canadian province concluded that every dollar invested in NSQIP resulted in a ROI = \$4.3 : 1.<sup>26</sup>
- Prehabilitation: Identifying modifiable risk factors and implementing strategies to reduce their risk e.g. anaemia, physical deconditioning, quit smoking, malnutrition before surgery. Small RCTs suggest a large reduction in complications, and good return on investment;<sup>27</sup> Medicare data from Michigan suggest improved discharge patterns, lower hospital and post-discharge costs, and per patient savings of approx. \$3,200.<sup>28</sup>
- High acuity postoperative care: This model allows higher risk patients to have extended care into the "golden hours" of the postoperative period e.g. inotrope support. This prevents deterioration of physiology postoperative with reduction in postoperative complications. Mixed data ranging from no clinical overall improvement to substantial cost and outcome benefits.<sup>29,30,4</sup>

## Conclusion

In the face of an existing and rapidly growing risk of postoperative complications with broad adverse impacts within and without the healthcare sector, there is an opportunity to collectively determine systems-based solution through a strategic and implementation plan to provide jurisdictions throughout Australia with guidance and options on how to deliver sustainable best practice care.

## Principles

In complex systems, strategies are more likely to be successful if there is a simple set of rules or principles which can be applied at all levels including the clinic and bedside. Principles need to be (i) tough; (ii) constrain us so that the rules can be adapted to local strategies; (iii) evidenced-based; (iv) patient-based; (v) applicable to public and private systems of health in Australia.

What follows is a suggested set if principles for discussion and modification at the meeting.

1. All planning must be based around the patient (their family, their expectations and needs)

Goals are pre-defined at each step, and agreed to by all clinicians and the patient

Goals align with patients stated wishes, including Shared Decision Making and Advanced Care Directive.

A coordinated perioperative plan of all aspects of care should be completed prior to the day of surgery

This should be available to all relevant clinicians and institutions

It should be agreed to by all, clinicians and institutions, and the patient and family

It should align with the patients' pre-defined expectations and goals

2. Risk assessment should be formally determined when surgery is considered

It should be re-evaluated by clinicians and patient and family prior to a final decision to proceed with surgery

Risk should be re-evaluated at all points in the patient journey.

Identified risk must always be matched to available management capacity , and the patient's goals. Modifiable risk requires this to be reversed in a timely manner and therefore systems redesign may be needed to ensure primary care physicians and/or anaesthetists with allied health clinicians see patients weeks before surgery to enact a management plan.

3. System thinking for perioperative care should apply for all surgery and procedures

Design the pathways with available evidence (as much as possible)

Pathways and processes should minimise variation, and maximise consistency, in care. Evidence-based pathways should be implemented and compliance audited and feedback at clinician level rather than administrative level.

Evaluation loops are inbuilt in the system (to improve the quality of evidence)

Evaluation should be based on the STEEP principles of healthcare

4. The pathway for managing surgical complications starts with primary care

This is first and foremost in the patients home.

Roles and responsibilities of each member team must be clearly defined and performed

Evaluation must be built into the system

5. The business case for quality should accompany all activities, initiatives and improvements in the system

6. Evidence-based approaches should be used within all elements of the system

Evidence gaps should be identified and addressed in a structured robust manner,

Evidence should be regularly reviewed

7. Appropriate performance measures should be in place, and guide quality

Performance measures will include structural, process and outcomes elements

Performance measures should include patient-centred and institution-focused measures

Risk-adjustment should be factored into all performance measures

Performance should be shared openly

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## Appendix 1

### **Some specific common (preventable) complications**

Death: 30-day; 90-day

Cardiovascular:

hypo/hypertension; AF; cardiac failure/fluid overload; myocardial infarction, thromboembolism

Respiratory:

atelectasis, infection, respiratory depression or failure (types 1 and 2)

Renal:

acute kidney injury

Neurological:

over-sedation; delirium; stroke; cognitive impairment

Gastro-intestinal:

nausea and vomiting; ileus

Metabolic:

hyper/hypoglycaemia

Infective:

infection; pneumonia, UTI, sepsis,

Surgical site:

surgical site infection (SSI); anastomotic breakdown

Other:

skin injury;

failure to achieve Return to Intended Oncologic (adjuvant) Therapy (RIOT) for cancer patients

### **ACSQHC: Hospital-acquired complications**

<https://www.safetyandquality.gov.au/our-work/indicators-measurement-and-reporting/complications/hacs-information-kit>

Pressure injury

Falls

Infection (healthcare-associated)

Surgical complications requiring unplanned return to theatre

ICU admission (unplanned)

Respiratory (failure, aspiration, pulmonary oedema)

Venous thromboembolism

Renal failure

GI bleed

Medication complications

Delirium

Incontinence

Endocrine (malnutrition, hypoglycaemia)

Cardiac (failure, rhythm, ACS, endocarditis)

Perineal laceration (severe)

Neonatal birth trauma

## Appendix 2a

**Risk factors and common outcomes and events from the NSQIP risk calculator**  
 (<https://riskcalculator.facs.org>)

### Patient and surgical factors

**Procedure** 44206 - Laparoscopy, surgical; colectomy, partial, with end colostomy and closure of distal segment (Hartmann type procedure) Clear

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a '+' in between, for example: "cholecystectomy + cholangiography"

Reset All Selections

**Are there other potential appropriate treatment options?**

Other Surgical Options  
  Other Non-operative options  
  None

*Please enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.*

<p><b>Age Group</b> 85 years or older</p> <p><b>Sex</b> Male</p> <p><b>Functional Status</b> Independent</p> <p><b>Emergency Case</b> No</p> <p><b>ASA Class</b> Severe systemic disease</p> <p><b>Steroid use for chronic condition</b> No</p> <p><b>Ascites within 30 days prior to surgery</b> No</p> <p><b>Systemic Sepsis within 48 hours prior to surgery</b> None</p> <p><b>Ventilator Dependent</b> No</p> <p><b>Disseminated Cancer</b> No</p>	<p><b>Diabetes</b> Insulin</p> <p><b>Hypertension requiring medication</b> Yes</p> <p><b>Congestive Heart Failure in 30 days prior to surgery</b> No</p> <p><b>Dyspnea</b> No</p> <p><b>Current Smoker within 1 Year</b> No</p> <p><b>History of Severe COPD</b> No</p> <p><b>Dialysis</b> No</p> <p><b>Acute Renal Failure</b> No</p> <p><b>BMI Calculation:</b></p> <p>Height: 69 in / 175 cm</p> <p>Weight: 243 lb / 110 kg</p>
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### Geriatric factors

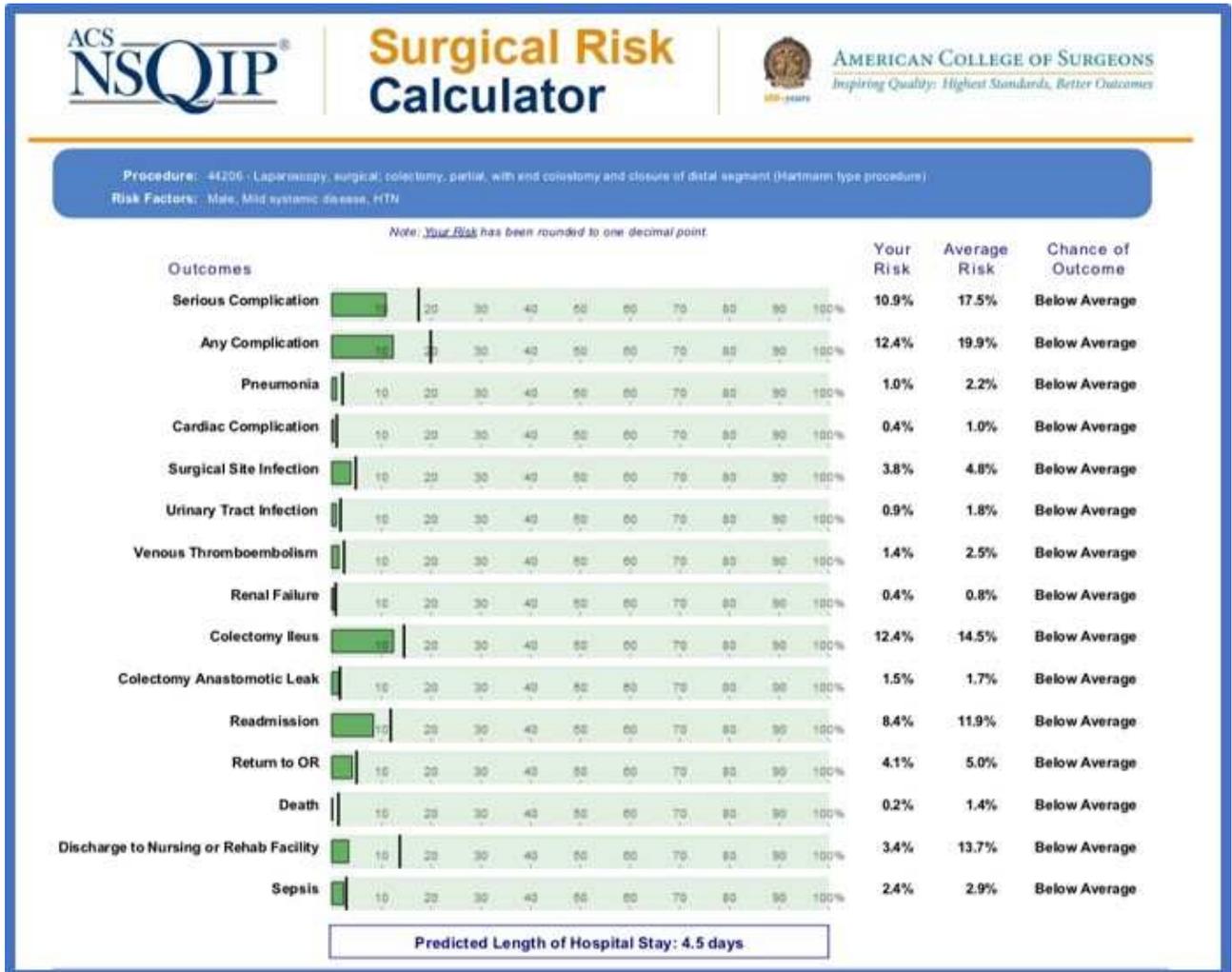
*Please enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.*

<p><b>Use Mobility Aid</b> Yes</p> <p><b>Origin Status from Home</b> Supported at home</p> <p><b>Fall History</b> Yes</p>	<p><b>Cognitive Status at Admit</b> No</p> <p><b>Palliative Care at Admit</b> No</p> <p><b>Competency at Admit</b> No, Patient signed his/her own consent</p>
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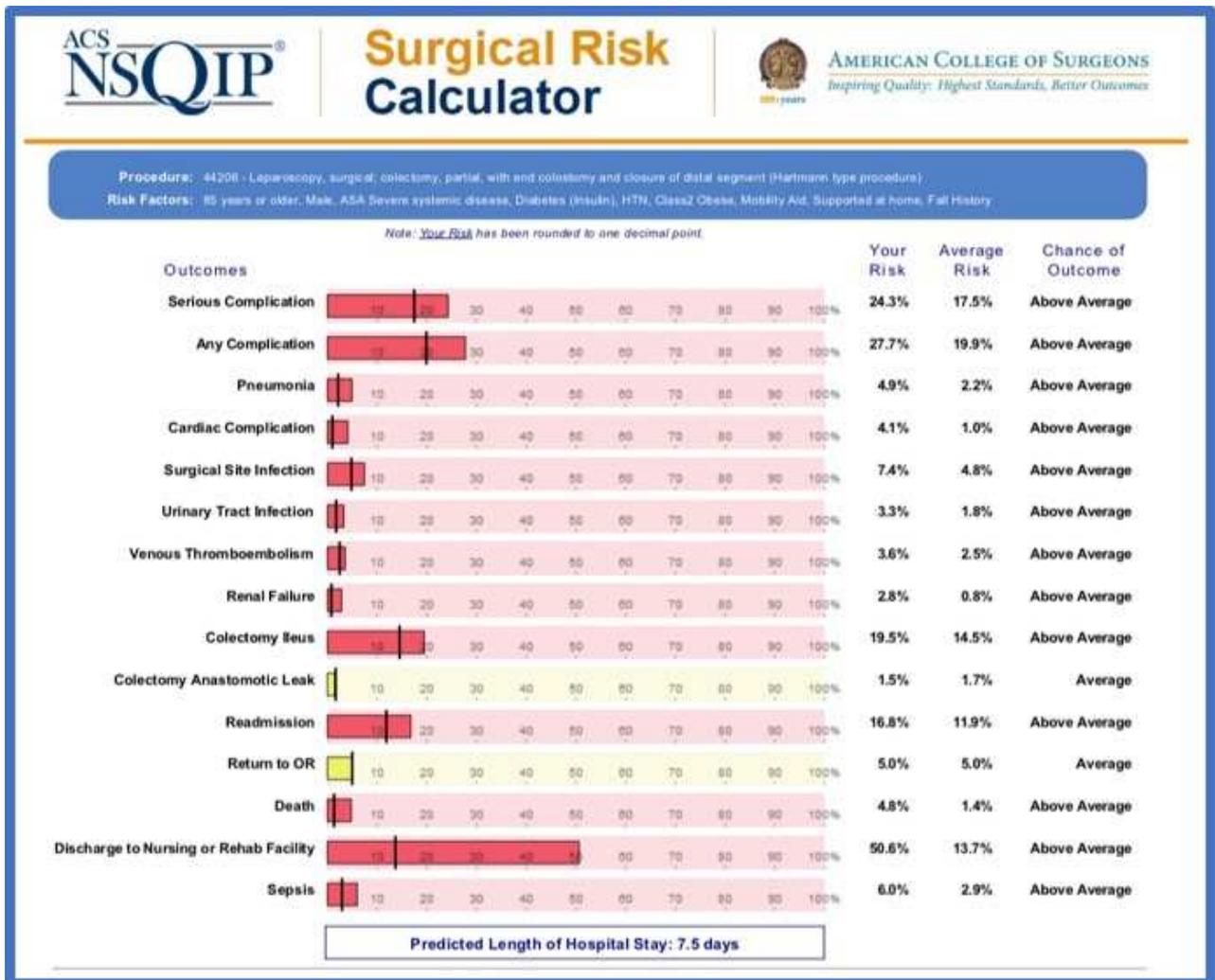
## Appendix 2b

### NSQIP outcomes and events for a low and higher risk patients following laparoscopic hemicolectomy and anastomosis (Hartmann's procedure)

'Low risk': <65 years, male, ASA 2, H/T



'Moderate risk': >85 yrs, H/T, ASA3, Diabetes, Obesity, Walking frame, Home Support, Falls



## Appendix 3

***Specific outcomes and events***, which may be measurable associations with specific complications

Serious inpatient adverse events:

Cardiac arrest; Medical Emergency Response (MER) calls; ICU consultation

Inpatient stay:

Recovery room length of stay; hospital length of stay; ICU/HDU stay;  
Hospital re-admissions (30-day; 90-day);

Post-discharge:

Rehabilitation length of stay; home nursing care  
Days at home after surgery (30-days, 90-days)  
Quality of life (30 to 365 days)  
Time to return to previous state of (in)dependency and functioning  
Need for family/carer support  
Time to return to employment  
Primary care consultations; Prescriptions

***Clinical (research) outcomes***<sup>31,33</sup>

(rated by the majority of experts as valid, reliable, easy to use, and clearly defined)

Surgical site infection at 30 days  
Stroke within 30 days of surgery  
Death within 30 days of coronary artery bypass grafting  
Death within 30 days of surgery,  
Admission to the intensive care unit within 14 days of surgery  
Readmission to hospital within 30 days of surgery,  
Length of hospital stay (with or without in-hospital mortality).

**Patient-centred (research) outcomes**<sup>33</sup>

One health-related quality-of-life measure (e.g. EuroQol 5 Dimension)  
One functional-status measure (e.g. WHO Disability Assessment Schedule)  
One life-impact measure (e.g. days out of hospital at 30 days after surgery).<sup>34</sup>  
Pain intensity (at rest and during movement) at 24 h postoperatively  
Nausea and vomiting (0-6 h, 6-24 h, and overall)  
Quality-of-recovery (QoR) scales (QoR score or QoR-15)  
Time to gastrointestinal recovery  
Time to mobilisation  
Sleep quality

## **ACHS Clinical Indicators**

Datasets are regularly reviewed to ensure: (i) they are relevant for clinicians; (ii) they continue to reflect today's healthcare environment; (iii) there is consensus on collection and reporting requirements; (iv) they are regarded as useful for quality improvement.

Reporting Healthcare organisations, 2018

Public: 348

Private: 308

Total: 656

HCOs providing data for one or more CIs within each CI set in 2018

Anaesth and Perioperative Care: 242

Intensive care: 89

Day patient: 277

Infection control: 343

Internal medicine: 25

Rehabilitation medicine: 121

## Appendix 5

### ANZCA Perioperative Medicine Multidisciplinary Working Group Perioperative Medicine Framework - extracts

#### The perioperative care framework

From the contemplation of surgery to recovery



ANZCA acknowledges the work of the POM Care Working Group in the development of this timeline.

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#### Underlying Principles

1. Shared decision making is a fundamental principle of high-quality perioperative care and is addressed at each step of the perioperative pathway.
2. Risk is reassessed throughout the perioperative pathway in order to prompt referral to the PoMT, inform shared decision making and direct appropriate use of resources. High-risk or vulnerable surgical patients may be identified using clinical judgement, risk assessment tools and recognition of geriatric syndromes such as frailty.
3. The perioperative care of high-risk surgical patients is best managed collaboratively by a multidisciplinary PoMT. The leader and members of the team should be individualised to the needs of the patient.