All-cause 30-day postoperative mortality for older patients in developed countries presenting for elective colorectal surgery: a systematic review protocol

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**Review question/objective**
The objective of this review is to provide an estimate of the prevalence of all-cause 30-day postoperative mortality for older patients in developed countries presenting for elective colorectal surgery.

**Background**
Outcome measurements are increasingly recognised as essential for healthcare quality and improvement. Thirty-day all-cause postoperative mortality is a widely accepted, valid and relevant outcome measure of surgical care.\(^1\)\(^-\)\(^4\) Thirty-day all-cause postoperative mortality is useful for benchmarking and quality assurance, and also to develop risk prediction scores that assist patient decision-making, especially as it relates to consent for surgery\(^5\). This data is of interest not only to patients, families and carers but also healthcare funders, policy makers, administrators and clinicians.

Colorectal surgery is surgery undertaken on the large intestine, including the right (ascending) colon, the transverse colon, the left (descending) colon (including the sigmoid colon) and the rectum. Colorectal surgery is recognised as a subset of general surgery with relatively high postoperative morbidity and mortality rates.\(^6\)\(^,\)\(^7\) There is little population data for entire countries or healthcare systems on patient outcomes following colorectal surgery. Colorectal surgery can be carried out as a planned, non-urgent procedure (“elective”), or as an immediately life-saving procedure (“emergency”). Thirty-day all-cause mortality is often aggregated for emergency and elective surgeries, and for widely variable patient groups (with respect to age, intercurrent medical conditions, and the exact disease indication for...
surgery). For colorectal surgery outcomes, for example, it may be difficult to predict outcomes for planned non-cancer surgery, as distinct from emergency life-saving surgery, or for surgery performed on well, younger patients compared with that performed on older, ill patients. Where available, large population reports for pooled age groups demonstrate 30-day mortality after elective colorectal surgery of between 1.9% and 6.2%, and a positive correlation between postoperative mortality and increasing age in all of these studies.

There is growing awareness of the need to calculate and communicate individual patient risk of death as a result of surgery, as part of the pre-operative discussion and informed consent process. In developed countries, there is also increasing recognition of the necessity to more appropriately align scarce postoperative resources with individual patient need. There are many factors which can influence postoperative mortality, including indication for surgery, patient age, presence of co-morbid medical conditions, anatomical location and grade of tumour (for cancer diagnoses) and the institution providing care. Most published data for elective colorectal surgery outcomes is for pooled populations including mixed indications for surgery, and various anatomical locations of surgery. There are a limited number of risk prediction tools available for use to inform the risk of all-cause 30-day postoperative mortality. In order to further develop valid risk prediction tools for individual patient application, it is necessary to have valid, contemporary measures for surgical populations that accurately evaluate the prevalence of adverse postoperative outcomes, including mortality.

In developed countries, the majority of patients proceeding to colorectal surgery have received a diagnosis of colorectal cancer. Where cancer is present, the tumour can be graded histologically (poorly, moderately or well-differentiated), and by stage (TNM: Tumour, Node, Metastasis). Long term outcomes (but not short-term survival) are affected by cancer stage and grade. Site of resection may affect short term mortality (left vs right colon, or rectum). Short term postoperative mortality for colorectal surgery patients may also be influenced by whether or not a blood transfusion was received. Higher blood transfusion rates are independently associated with increased 30 day mortality after non-cardiac surgery, and these transfusion triggers or practices may vary between institutions.

With the exception of malignant tumours, indications for colorectal resection can also include benign neoplasms (non-cancerous growths), diverticular disease (a non-cancerous bowel condition which can result in ‘diverticulae’ or pouches of bowel, which may rupture, or become infected), ischaemic bowel disease (inadequate blood flow to the bowel), volvulus (twisting of the bowel), and other reasons. While many patients with a primary cancer diagnosis are likely to proceed to surgery irrespective of operative risk, the same may not be true for patients with non-cancerous conditions, or for those in whom the outcome of surgery is highly uncertain. The likelihood of dying after surgery increases with age. As patients age, the incidence of cancer and diverticular bowel disease also increases. This means that older patients are increasingly likely to be required to consider the risks and benefits of colorectal surgery, for cancer and other conditions.

There have been numerous innovations and improvements in the management of patients presenting for colorectal surgery in recent years. In particular, the use of laparoscopic (“minimally invasive”) surgical techniques, combined with enhanced recovery (“fast track”) programmes have resulted in both reduced lengths of hospital stay and complication rates after surgery. Recent systematic reviews have demonstrated equivalent mortality rates, in developed countries, for laparoscopic vs conventional surgery in elderly patients, and also for enhanced recovery vs conventional postoperative
management across most age groups. However, absolute mortality rates are not commonly reported in such reviews. Grailey\textsuperscript{15} reported 30-day mortality data for patients over 70 years of age as an odds ratio for laparoscopic vs conventional surgery, and Zhuang\textsuperscript{16} reported the relative risk of 30 day mortality for enhanced recovery after surgery vs conventional care, across all age groups.

In developed countries, a measure of 30-day all-cause postoperative mortality for large populations of elderly patients undergoing elective colorectal surgery remains a significant gap in the published literature. Providing an estimate is likely to enhance decision-making from many perspectives, including:

Public policy makers: The proposed systematic review will provide an assessment of overall mortality from pooled surgical populations of older patients presenting for colorectal surgery, which may be useful for policy makers in the absence of a local population-specific measure. With an ageing population, there will be an increase in the burden of colorectal cancers.\textsuperscript{17} Many countries, including Australia, have instituted national bowel cancer screening programmes,\textsuperscript{18} to target the increasing rates of colorectal cancer. Such programmes are effective at saving lives, as cancer or pre-cancerous lesions detected through screening can be treated with elective surgery.\textsuperscript{19} As these screening programmes are extended to older patients, it will be important to know all outcomes from all interventions (including surgery) for lesions detected by screening.

Healthcare funders: In most developed nations, surgery accounts for a considerable proportion of the healthcare budget. The total Australian healthcare budget in the year 2010-11 was $130 billion, of which approximately $39 billion was spent on public hospital services.\textsuperscript{20} Just over 25% of these services were accounted for by patients who received surgery. According to the Australian Institute of Health and Welfare,\textsuperscript{20} on average, 5,000 people in Australia are admitted to hospitals for elective surgery each day. Currently, in developed nations there is no country- or system-wide routine collection of post-surgical outcomes. Thus there is very little information available to assess the value of this spending, and to inform decisions on where to prioritise funds in terms of surgical services.

Hospitals and clinicians: In Australia, the largest available database concerning adverse outcomes from surgery\textsuperscript{21} is a voluntary reporting system, which is largely used to provide feedback to individual clinicians (surgeons). While the data is publically available, the lack of reliable data for the total number of surgeries undertaken in Australia each year makes it difficult to derive a valid estimate of the overall surgical mortality, particularly for different types of surgery, including colorectal surgery. There has been much debate in the UK about national and regional variations in surgical outcomes, and the necessity to more closely align patient need (based on risk of poor postoperative outcome) with appropriate postoperative resources.\textsuperscript{9,22} When interpreting outcome data, it is essential that the reader is informed of the various pathophysiological and surgical factors, and systems-of-care that can impact on the outcome of interest. Although it is recognised that such risk adjustment can be challenging, the results of the proposed systematic review may be useful for benchmarking (of hospital networks, units and departments, and/or individual clinicians), for quality improvement purposes, and also for hospital level resourcing and prioritizing decisions.

Patients and carers: Availability of 30-day all-cause postoperative mortality data is likely to be of significant interest to patients and their families, particularly when making decisions regarding elective non-cancer surgery. Decision-making under conditions of uncertainty, especially when considering the risks and benefits of the proposed treatment, requires complex trade-offs, and information about the
range of potential outcomes may be very useful. For truly informed consent, the potential range of outcomes should be individualised as much as possible. Increasingly, risk prediction scores are used for this purpose. The background to these risk prediction scores is described as useful "...as surgical culture moves more towards outcome measures and providing the patient (as the end user of the service) with as much information as possible to make fully informed consent". However, creation of valid risk prediction scores requires the availability of population-wide prevalence data. For elective surgery, it is difficult to individualise a risk of mortality without fully understanding the factors underpinning population-based mortality likelihoods. The results of the proposed systematic review will assist with this understanding.

Older patients: Most of the published data clearly demonstrates an increase in adverse outcomes, including mortality, from all elective surgery with advancing patient age. With an aging population, and with increased anesthesia-related safety patients are increasingly referred for surgery that was unavailable to previous generations of older citizens. Pooled age estimates for surgical survival may present an unrealistic risk assessment for older patients (who are known to have poorer survival than younger patients). For all the reasons outlined, but particularly with regard to preserving and respecting patient autonomy, elderly patients need accurate, contemporary and age appropriate risk information on which to base their decision-making for elective surgery. This systematic review aims to provide more specific information on expected outcomes for elderly patients presenting for elective colorectal surgery.

The proposed systematic review will provide an estimate of 30-day all-cause postoperative mortality, which is currently neither widely collected nor reported for the population of interest (older patients having elective colorectal surgical resection). The estimate of 30-day all-cause postoperative mortality for this group of patients will be useful for individual patients and their families (to assist with informed decision-making for surgery), for hospitals and clinicians (for benchmarking and quality improvement purposes), and for healthcare funders and policy makers (who are interested in the results, and hence the value of healthcare spending).

Colorectal surgery is increasingly offered to, and performed for older patients. Worldwide, and particularly in developed nations, it is expected that the funds allocated to elective surgery will be aligned with postoperative outcomes (including mortality), in order to demonstrate value for money. Currently, surgical outcome data may be available to individual surgeons (for their own quality assurance purposes), but in Australia, as for most developed nations, this data is not made widely available to clinicians other than surgeons, to hospitals, to healthcare funders, nor to patients. The proposed systematic review will improve the quality of available information to support individuals and institutions to make better healthcare decisions.

Keywords

colorectal surgery, mortality, death, fatal outcome

Inclusion criteria

As this review will report on the prevalence of mortality as an adverse outcome of a surgical intervention, the format does not conform to the standard PICO/PIO question.
Types of participants

This review will consider studies that include patients aged 65 years and over from developed countries, presenting for elective colorectal surgical resection. For the purposes of this review, developed countries will include only counties with a very high Human Development Index\(^2\). Studies including patients from countries without a very high HDI will be excluded. Patients having colorectal resection with or without anastomosis (joining of the ends of resected bowel) will be included. Patients having exploratory or diverting procedures (for example, patients who at surgery are found to have widespread disease which is unsuitable for operation) will be excluded from this review.

Types of outcomes

This review will consider studies that include the following outcome measures: rates of 30-day all-cause postoperative mortality (that is, patients dying from any cause within the first 30 days after surgery).

Types of studies

This review will consider both analytical and descriptive epidemiological study designs including prospective and retrospective cohort studies, case series and cross-sectional studies. As the mortality rate could be as low as 2% (1:50 cases), studies with a minimum sample size of 150 will be considered. This sample size requirement accords with Hanley’s ‘rule of three’\(^2\).\(^6\) This rule is helpful when considering the confidence intervals of the probabilities for adverse outcomes, and states that if \(n\) adverse event occurrence rate, the upper limit of the 95% confidence interval for the probability of an adverse event is \(3/n\). This rule is applied to determine minimum sample size for included studies, to minimize the potential for small samples to skew event rate estimates.

Search strategy

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of PubMed will be undertaken followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe the articles. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference lists of all identified reports and articles will be searched for additional studies. Only studies published in English will be considered for inclusion in this review. Studies published after 1998 will be considered for inclusion in this review, in order to provide a mortality estimate which accurately reflects the improvements in surgical care (particularly laparoscopic approaches, and enhanced recovery pathways) which have only been introduced in the developed nations since the 1990s.

The databases to be searched include: PubMed, EMBASE, Scopus and The Cochrane Central Register of Controlled Trials.

The search for unpublished studies and grey literature will include: Google Scholar, The Grey Literature Report (The New York Academy of Medicine) and the World Health Organisation.

Initial keywords to be used will be: colorectal surgery, mortality, death, fatal outcome
Search strategy for PubMed:


AND


As the results for the population of interest (older patients presenting for elective surgery) may be included in larger studies or surveys of pooled emergency and elective patients, and/or studies of adults of all ages, there will be no limitations applied to the search with regard to age, or type of surgery (i.e. elective surgery). A search limited to older patients and/or elective surgery could lead to oversight of relevant and extractable data.

Assessment of methodological quality

Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments adapted from the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix I). Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Data collection

Data will be extracted from papers included in the review using a data extraction tool adapted from JBI-MAStARI (Appendix II). The data extracted will include specific details about the interventions (types of surgery and surgical techniques, including laparoscopic or open procedures), populations (age, comorbidities, pathologic indications for surgery including extent of malignant disease), setting and models of care (country, type of institution/hospital, postoperative care plan and environment, including transfusion strategy if reported), and other treatments involved (chemotherapy or radiotherapy if provided).

Data synthesis

Quantitative data will, where possible, be pooled in statistical meta-analysis using JBI-MAStARI. All results will be subject to double data entry. All-cause 30-day postoperative mortality will be expressed as a percentage, and 95% confidence intervals will be calculated for analysis. A random effects model will be used and heterogeneity will be assessed statistically using the standard Chi-square. Where statistical pooling is not possible, the findings will be presented in narrative form including tables and figures to aid in data presentation where appropriate.

Conflicts of interest

Nil
Acknowledgements

Grateful thanks to Drs Suzanne Robertson-Malt and Cindy Stern, and also to Associate Professor Alexander Engel, for their expert assistance (and good humour) during the preparation of this protocol. Many thanks also to Terrence Lane for his role as second reviewer during this process.
References


18. Australian Government Department of Health and Ageing website


23. Risk Prediction in Surgery website [Internet][cited 2013 Apr 27]. Available from
www.riskprediction.org


Appendix I: Appraisal instrument

MAStARI appraisal instrument:

Adapted from JBI Critical Appraisal Checklist for Observational Cohort/Case series/Cross sectional studies

Reviewer: 
Date: 
Author: 
Year study published: 
Record number: 

1. Is the sample representative of patients in the population as a whole?  Y  N  Unclear  N/A
2. Are the patients at a similar point in their disease/illness?  Y  N  Unclear  N/A
3. Were criteria for inclusion in the study clearly defined?  Y  N  Unclear  N/A
4. Were confounding factors identified and strategies to deal with them stated?  Y  N  Unclear  N/A
5. Are outcomes assessed using objective criteria?  Y  N  Unclear  N/A
6. Was follow-up carried out over a sufficient time period?  Y  N  Unclear  N/A
7. Were outcomes for people who withdrew described and included in the analysis?  Y  N  Unclear  N/A
8. If any subjects were lost to follow up, was this made clear?  Y  N  N/A
9. Were outcomes measured in a reliable way?  Y  N  Unclear  N/A
10. Was appropriate statistical analysis used?  Y  N  Unclear  N/A

Overall appraisal

Include

Exclude

Seek further info

Comments (including reasons for exclusion)
Appendix II: Data extraction instrument

MAStARI data extraction instrument:
Adapted from JBI Data Extraction Form for Experimental/Observational Studies

Reviewer: ____________________________________________
Date: _____________________________________________
Author: ___________________________________________{
Year: _____________________________________________

Study method:
RCT: __________
Quasi RCT: _________
Retrospective: __________
Prospective Observational: __________
Longitudinal: __________
Other: _____________________________________________

Date (Years) of intervention: 1998-2003____  2003-2008____  2008-2013_____ 
Setting/Hospital
type: _____________________________________________
Type (anatomical site) of surgery: ________________________
Type of surgery (laparoscopic, open): _____________________
Pathology/indication for surgery: _______________________
Elective surgery only: _________________________________
Elective plus emergency cases: _________________________
Model of care (post op care setting/transfusion strategy): _________________________________
Age range of patients: _________________________________
Comorbidities: ______________________________________
Other treatments (chemo/radiotherapy): _______________________

Sample size: ____________________________
30 day Postoperative Mortality: ________________________

Authors’ conclusions: _______________________________________
Reviewers’ conclusions: _______________________________________

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