

Oliver Groene

*“You cannot swim for new horizons until you have courage to lose sight of the shore.”*

—William Faulkner

## A Framework to Study Errors and Harm

Hundreds of people are admitted to hospitals every year. In the UK, there are about 17 million hospital admissions annually; about one-third of admissions are for a surgical procedure. In high-income countries most procedures are conducted safely; yet, unfortunately some patients experience adverse events, resulting in harm or even death. The proportion of patients experiencing harm remains significant, despite the major focus on improving patient safety in the last decade [1].

There are many ways to define harm. The WHO/World Alliance for Safer Healthcare defines healthcare-related harm as ‘*an injury arising from or associated with plans or actions taken during the provision of healthcare, rather than an underlying disease or injury*’ [2]. Harm may result in temporary or permanent lessening of body sensory, motor, physiologic or intellectual function. The definition clearly relates harm to actions of healthcare provision although it fails to capture harm from acts of

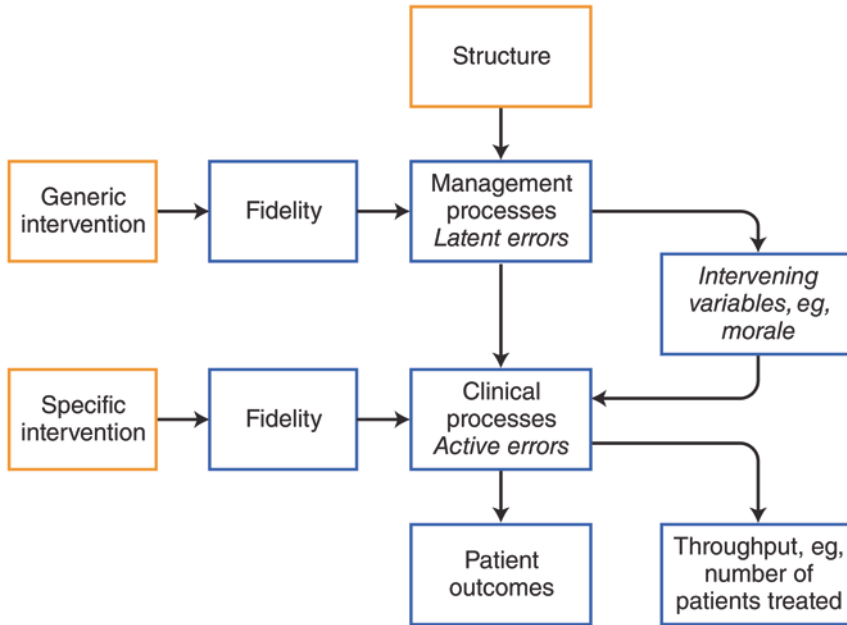
omission. Others suggest a broader definition that covers patient harm resulting from acts of commission (affirmative actions such as incorrectly conducted procedure) or acts of omission (such as failure to treat a condition), as well as unintended complications of healthcare [3]. Preceding harm and adverse events are incidents or near misses, unintended or unexpected incident that could have harmed patients, but did not [4].

In this chapter we consider harm as an adverse outcome of structural and process factors within hospitals. Brown et al. proposed a framework to study these relationships, building on Donabedian’s structure-process-outcome model and the work of James Reason on latent and active errors [5]. In the framework, *management processes* cover for example human resource policies: training of new staff or management of the supply chain. Latent errors related to such management processes might expose clinicians to outdated work practices or indirectly put patients at risk. *Clinical processes* cover the adoption of particular safety/evidence-based practices and the quality of procedure. Active errors in clinical processes directly put patients at risk and may cause harm or death. The model is important for an understanding of a systems perspective on latent and active errors, and the complex relationship between wider management processes, clinical processes, and patient outcomes [6]. Latent and active errors may lead to an adverse event (or patient incident), but not all adverse events also cause a permanent harm to the patient (Fig. 2.1).

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O. Groene, PhD, MSc, MA (✉)  
OptiMedis AG, Burchardtstrasse 17,  
Hamburg 20095, Germany

Department of Health Services Research and Policy,  
London School of Hygiene and Tropical Medicine,  
Tavistock Place 17-19, WC1H 9SH London, UK  
e-mail: [o.groene@optimedis.de](mailto:o.groene@optimedis.de);  
[oliver.groene@lshtm.ac.uk](mailto:oliver.groene@lshtm.ac.uk)



**Fig. 2.1** General and specific interventions across the system and evaluation end points (modified from Brown et al.)

This epistemology of surgical safety is applicable to a wide range of settings. In low-income countries many people don't have access to safe surgery and the study of surgical safety differs methodologically, because of lack of access to high-quality data and care.

Nevertheless, data on surgical safety in low- or middle-income countries is starting to emerge [7]. It represents a significant problem, especially considering the global strategy towards universal healthcare coverage (which currently may imply access to unsafe surgical practices).

## The Scale of Harm in Surgery

There have been major achievements in surgery in the last 100 years, made possible through infection prevention, safe anaesthesia, modern operation theatres and minimal invasive techniques. The World Health Organization (WHO) estimates that about 234 million major surgical procedures are undertaken every year worldwide [8]. Despite improvements in surgical safety, reducing the

amount of harm caused by surgery remains a challenge, as the nature of surgery changes and becomes much more complex, involving an ever-increasing number of team members in surgical preparation, conducting the procedure and providing complex follow-up care.

For example, the number of team members (surgeons, anaesthesiologists, operating room nurses) directly involved in a typical surgical procedure might be, six, but the total number of staff involved in organising, administering and delivering the clinical care process leading to, and following from, the surgery might be ten times this number [9]. Due to the complexity of the care pathway, perioperative care processes are becoming more prone to both latent and active errors. Patients may experience severe harm and even death even if the actual surgical operation is uneventful, because of latent and active errors in recognising and effectively managing a major complication following the surgery [10, 11].

The United Kingdom's National Reporting and Learning System (NRLS), the largest repository of patient safety incidents worldwide, gives

**Table 2.1** Selected results of retrospective care record reviews (after deVries [13])

Study	Harvard Medical Practice study	Quality in Australian Health Care study	Utah and Colorado Study	Vincent et al. study	Adverse events in New Zealand Public Hospitals	Canadian Adverse Event Study
Country	USA	Australia	USA	England	New Zealand	Canada
Year	1984	1992	1992	1998	1998	2000
Cases reviewed	30,121	14,179	14,700	1014	6579	3745
Adverse event rate	3.8 %	16.6 %	3.9 %	10.8 %	11.2 %	6.8 %
Preventable adverse events	1.0 %	8.5 %	0.9 %	5.2 %	4.8 %	2.8 %

an indication of the scope of incidents and harm: About 1.3 million incidents were reported by NHS organisations between July 2011 and June 2012 in England, although it is recognised that probably only about 25 % of incidents in hospitals are reported. The majority of incidents (875 k) caused no harm, with 7773 causing severe harm and 3263 resulting in death. The most common type of incident reported was a patient accident (25.8 %), followed by treatment/procedure (12.7 %) or medication error (12.1 %) [12].

The most detailed data on patient harm comes from retrospective care record reviews. This method traditionally consists of two stages: a nurse reviewer identifies patient records where certain preset criteria suggests patient harm, followed by a second-stage review by an experienced clinician who judges whether patient harm indeed occurred, and whether it was due to acts of omission or commission. Compared to routine data sources, the method has the advantage of being based on a rich description of the care pathway and supported by explicit standards and criteria. However, the review has also been shown to have low inter-rater reliability, particularly regarding the assessment of the causes of patient harm and its preventability.

A meta-analysis of the seminal retrospective case record reviews, which included 74,485 patients, found an adverse event rate of 9.2 %. Of these nearly half (43.5 %) were deemed preventable [13]. Surgery was the largest area where adverse events occurred (39.6 % of all cases), followed by drug-related events (15.1 %). The rates of harm measured differed substantially between

individual studies, mainly because the methods and the definition of harm varied.

Selected results of seminal retrospective care record reviews are presented in Table 2.1.

Key areas for surgical safety relate for example to site infections, anaesthesia or retention of instruments [14]. Surgical site infections account for 15 % of all nosocomial infections and in surgery represent the most common nosocomial infection (37 %) [15]. The overall risk of acquiring a surgical site infection is low (2–5 % of all surgical patients); however, considering the volume of operations the absolute number of surgical infections is significant. Patients with a surgical site infection need a longer hospital stay, have higher rates of readmission and are at high risk of substantial permanent morbidity, or mortality [16]. The retention of objects after surgery is another rare event, but where it happens it can cause major morbidity and mortality. A study at the Mayo clinic found that in one of every 5500 operations a foreign object was retained, in the majority of cases (68 %) surgical sponges. The greatest risk from retained objects is an infection, but surgical instruments can also cause perforations and granulomas [17]. Anaesthesia has become very safe in developed countries. Studies vary in suggesting that an adverse event leading to death occurs in every 10,000 to every 185,000 patients; that is, even in the worst case an anaesthesia-related death will be a very rare event. However, in developing countries anaesthesia represents a tangible risk, leading to a death in every 3000 patients (Zimbabwe) or even every 150th patient (Togo). The causes are predominantly

related to airway problems or anaesthesia in the presence of hypovolaemia.

Despite the advances in surgical safety, with the increasing volume of operations and the complexity of procedures and team organisation a systematic approach towards improving perioperative safety is needed. Considering the large volume of surgical procedures and the rates of harm caused by surgery, WHO considers surgical safety as a public health crisis, particularly in low-income countries.

### **Solutions to Prevent Errors and Harm in the Perioperative Arena**

Since the publication of the influential ‘To Err is Human’ report in the year 2000, there has been substantial increase in research on improving surgical safety. Early findings on evidence-based strategies are summarised in the AHRQ report ‘Making Health Care Safer: A Critical Analysis of Patient Safety Practices’ [18]. However, the report also identified major gaps in knowledge, in particular the limitations in the epistemology for the study of patient safety, the relevance of context factors for the implementation and the impact of the broader health system environment. Since then a major international effort has focused on reviewing patient safety practices, supporting original research and widening the scope of implementation efforts. An update of strategies to improve patient safety was published in 2013, based on a review of strategies contained in Making Health Care Safer, Joint Commission standards, Leapfrog Group strategies [19]. The report identified 22 strategies ready for adoption, with a ‘top ten’ list of patient safety strategies that were so strongly recommended for adoption that the authors stated that ‘our expert panel believes that providers should not delay adopting these practices’. Of the top ten patient safety strategies, recommendation number 1 relates specifically to the perioperative area, namely the introduction of preoperative checklists and anaesthesia checklists

#### **Text Box 2.1: Strongly Encouraged Patient Safety Practices (Modified from Shekelle et al.)**

- Preoperative checklists and anaesthesia checklists to prevent operative and post-operative events
- Bundles that include checklists to prevent central line-associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine and subglottic suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- The do-not-use list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent health care-associated infections
- Use of real-time ultrasonography for central-line placement
- Interventions to improve prophylaxis for venous thromboembolisms

to prevent operative and post-operative events (Chap. 26) (Text Box 2.1).

Six of the recommended patient safety strategies are very germane to the perioperative area, namely obtaining informed consent on potential risk of procedure, team training, computerised provider order entry, use of surgical outcome measurements and report cards, rapid-response systems, use of complementary methods for detecting adverse events or medical errors to monitor for patient safety problems, simulation exercises, or documentation of patient preferences for life-sustaining treatment.

This list also demonstrates that in order to improve surgical safety, a broader view of the surgical pathway is needed than encompassed by the activities and actual procedure conducted in the operating theatre. Improving safety and quality in the surgical domain requires actions that go beyond the responsibility of the surgical microsystem where the problem is observed (for example the failure to rescue after high-risk surgery) [20, 21].

The international DUQuE Consortium conducted the largest collaborative project investigating the effects and impact of quality management systems in European hospitals [22]. It formulated and tested hypotheses regarding the implementation of quality management systems, their associations with other factors known to affect quality and their effect on quality of care in various care pathways that reflect the diversity of hospital operations [23]. In addition, the consortium conducted a series of systematic reviews of the key strategies to improve quality and safety in hospitals, extracting information on their effectiveness and on contextual factors affecting their implementation [24]. Based on this body of work, seven key strategies to improve quality and safety were recommended [25] (Table 2.2).

Despite the emerging evidence on the impact of strategies to improve quality and patient safety, questions have been raised why the progress is so slow, with some studies even suggesting an increasing incidence of patient harm over time [1]. According to Shojania and Thomas this is because (a) the identification of interventions to reduce patient safety problems has been slower (and many interventions have been less effective) than expected, (b) the patient safety practices demonstrated to be effective (see above) are not sufficiently implemented on a wide scale, and (c) the measurement of improvement efforts is much harder than the measurement of problems [26, 27].

This is demonstrated by the concerted effort to improve patient safety on the one hand, and an assessment of the implementation progress in the hospital setting of the recommended patient safety practices. International patient safety efforts include the Global Patient Safety Alliance

launched by the WHO and the Health Care Quality Indicator Project led by the Organization for Economic Co-operation and Development (OECD). In Europe, the Safety Improvement for

**Table 2.2** Seven key strategies to improve quality and safety in hospitals (modified from Groene, Kringos, Sunol [25])

Strategy	Evidence
Aligning internal organisational processes with external pressure	There is mounting evidence from close to 100 scientific studies to suggest that undergoing external assessment improves the organisation of work processes, and promotes changes and professional development
Putting quality high on the agenda	Simply put, research suggests that hospitals in which leaders are involved in quality reach better quality-of-care outcomes. Lack of senior leadership affects patient care even where patient care in clinical units is pursued by competent and dedicated professionals
Implementing supportive organisation-wide systems for quality improvement	Multiple quality systems operate within any hospital. These quality systems need to be well aligned to maximise impact and minimise unnecessary bureaucracy or documentation that takes time away from patient care
Assuring responsibilities and team expertise at departmental level	High-quality care cannot be provided without well-trained and motivated professionals. A key strategy to improve the quality of care is thus the recruitment, retention and development of professionals with the right competences
Organising care pathways based on evidence of quality and safety interventions	The majority of hospital departments still follow a traditional organising principle according to the medical specialisation. To better respond to current patient's needs, an organisation based on care pathways should be pursued in which all clinical activities are centred on the patient's overall journey

(continued)

**Table 2.2** (continued)

Strategy	Evidence
Implementing pathway-oriented information systems	Hospital information systems (covering computerised clinical decision support systems in hospitals, electronic health records, computer-assisted diagnosis, reminders for preventive care or disease management or drug dosing and prescribing) have an enormous potential to improve quality and safety of healthcare. The effectiveness of computerised clinical decision support systems has been evaluated by more than 300 studies
Conducting regular assessment and providing feedback	Audit and feedback are key quality improvement strategies, which can be applied individually or as part of multifaceted interventions. Audit and feedback have been well researched in more than 100 studies to support the assumption that professionals improve their performance when feedback demonstrates deficiencies in process or outcomes of care

Patients in Europe (SImpPatIE) project established a common European vocabulary and a set of indicators and internal and external instruments to improve safety in healthcare. The European Network for Patient Safety (EUNetPaS) created an umbrella network of all European Union (EU) member states and stakeholders to enhance collaboration in the field of patient safety. The joint action on Patient Safety and Quality of Care has identified activities and tools for mutual learning among all EU member states. In an assessment of the implementation of patient safety practices and the evidence-based organisations of patient care according to the recommendations of the agencies above, they found in a large random sample of EU hospitals that neither patient safety practices nor were routinely followed with a substantial variation in how care was delivered between departments and hospitals. This raises serious concerns regarding the

delivery of optimal care and indicates substantial room for improvement [28].

## Surveillance and Monitoring of Surgical Safety

The capacity of countries and hospitals to assess the amount of harm caused differs substantially. As referred to above, the majority of studies on adverse events have used the retrospective case record review. The method has the advantage that assessments are conducted by clinicians with experience in the content area, but has shown to have limited inter-rater reliability between clinicians that are judging whether an adverse event occurred or whether harm was preventable. The method is also costly and time consuming and therefore not well suited for routine assessments and monitoring. Various alternative sources exist to assess adverse events. For example, in England there are about 50 National Clinical Audits that prospectively collect national level data for a range of conditions that involve a surgical procedure, such as cancer surgery, cardiac surgery or orthopaedic surgery replacement. These National Clinical Audits collect data, for example, on complications during index hospitalisation, unplanned admission to ICU or return to theatre [29]. However, these National Clinical Audits do not cover the whole spectrum of patient care delivered and they differ significantly in terms of methodological robustness, scope and reporting mechanisms [30].

Another source of data is hospital administrative data, which have been used previously to construct patient safety indicators in the USA and its use in monitoring healthcare quality and safety [31]. The quality of administrative data has improved a lot in the last decade. It now includes more clinically relevant data items, coding of data have improved and data on a large number of patients can be extracted easily, it provides the statistical power for the study of rare events that other methods might lack.

In England, Hospital Episode Statistics (HES) have been used extensively to assess and monitor patient safety. For example, an assessment of



Hospital Episode Statistics found that about 2.2% of all hospital admission records contain one or more of the 41 adverse events or misadventure codes that are used to document surgical or obstetric harm or other complications [32]. HES data has been used to explore specific measures of patient harm based on the patient safety indicators developed by the Agency for Health Care Research and Quality (AHRQ) and subsequently adapted internationally [33]. Examples of patient safety events that can be monitored using this data include catheter-related bloodstream infections, post-operative DVT and pulmonary embolism, post-operative sepsis, accidental puncture or laceration, or a foreign body left in the body during a procedure. These indicators can be computed by using algorithms that combine the coding of primary and secondary diagnoses with a range of procedure codes [34]. In addition, HES can be used to identify possible proxy measures of harm such as emergency readmissions to a hospital after an index admission for a surgical procedure. An overview of British studies suggested that 15.6% of readmissions could be avoided, but estimates vary largely depending on the clinical condition or type of codes considered [35].

Importantly, in deciding how to monitor and assess surgical safety, the level of granularity and the intended purpose need to be clearly specified. Levels of granularity include the health system level, the institutional (hospital) level, the team level and the individual surgeon level. It is important to emphasise that an indicator that is valid and reliable at one of these levels is not necessarily valid and reliable at another level. This is first because of the differences in the underlying denominators which impact on the signal-to-noise rate and the possibility to reliably detect the event, and secondly, because of differences in the attribution of this event to an act of omission or commission, resulting from a latent or active error. Most patient safety indicators have been validated at a fairly high level (health systems or institution) and are not fit for reporting at the team or surgeon levels. Furthermore, when com-

paring outcomes between hospitals, risk adjustment for patient characteristics is crucial because, when patient populations differ between hospitals, differences in outcome may represent differences in baseline risk rather than in quality of care. Insufficient case-mix adjustment can lead to unfair comparisons. This is of particular relevance where surgery bears substantial risks [36].

In the UK, an ambitious surgeon reporting programme has been implemented in 2015, brought on by various high-profile scandals about bad-quality care. Today, surgeon reports are seen as a central tool for quality improvement. Since 2013 individual surgeons' outcomes are made public via NHS choices. Data is published for 5000 consultant surgeons in 12 specialties (adult cardiac surgery, bariatric surgery, colorectal surgery, endocrine and thyroid surgery, head and neck cancer surgery, interventional cardiology, lung cancer, neurosurgery, orthopaedic surgery and upper gastrointestinal surgery). Data source and measures vary among specialties, but all include mortality rates for their patients (Table 2.3).

Whether surgeon reports can be an incentive for quality improvement cannot be easily answered [37]. From a behavioural economics perspective, these reports can be seen as a 'nudge' that provides feedback to intrinsically motivated surgeons, who will then act accordingly and try to improve. Because of the methodological limitations of the underlying data it is also possible that the data causes more harm than good, by unnecessarily alerting surgeons and the public, or by creating pressures to avoid particular patient groups [38].

In order to support the improvement of quality and safety in surgery, a stronger focus should be on the upstream determinants of safety, or as in Brown's framework the management processes leading to active error, rather than mortality and morbidity outcomes only [6, 39]. This should include an assessment of the implementation of established patient safety practices and a timely monitoring of team based process measures that are clearly linked to patient outcomes [40].

**Table 2.3** Clinical example of the data included on surgical report cards

	Procedures included	Total cases included	Number of consultants	Mean procedures/consultant	Outcome measure	Mean rate
Cardiac surgery	Adult cardiac operations	Approximately 100,000	248	Unclear	In-hospital mortality	3.1 %
Vascular surgery	Infrarenal abdominal aortic aneurysm repair (AAA) and carotid endarterectomy (CE)	21,266 AAA: 15,751 CEA	458 AAA: 429 CEA	32 AAA: 31 CEA	AAA repair: In-hospital mortality CEA: 30-Day stroke/mortality	2.2 % (AAA) 2.4 % (CEA)
Thyroid and endocrine surgery	Thyroid operations: Lobectomy, isthmusectomy, and total thyroidectomy	13,233	125	Unclear: Approximately 91	In-hospital mortality; re-exploration for re-bleeding; readmission rate; proportion of patients who developed late hypocalcaemia; length of hospital stay (all first-time thyroidectomy)	0.1 % In-hospital mortality 1 % Re-exploration for re-bleeding 2 % re-admission 9 % Hypocalcaemia
Orthopaedic surgery	Hip replacement, and knee replacement	Unclear	Unclear	63 Hip: 54 Knee	90-Day mortality	0.6 % Hip replacement 0.4 % Knee replacement
Urology	Nephrectomy	5449	283	14	30-Day mortality; rate of post-operative complications; transfusion rate; and length of hospital stay	<3 % <9 % <15 %
Upper GI surgery	Oesophagectomy or gastrectomy with curative intent	2381	163	14 (median)	30-Day mortality rate	2 %



## References

- Baines R, Langelaan M, de Bruijne M, Spreeuwenberg P, Wagner C. How effective are patient safety initiatives? A retrospective patient record review study of changes to patient safety over time. *BMJ Qual Saf.* 2015;24(9):561–71. doi:10.1136/bmjqs-2014-003702.
- World Health Organization. Safe Surgery Guidelines. [http://www.who.int/patientsafety/safesurgery/tools\\_resources/9789241598552/en/](http://www.who.int/patientsafety/safesurgery/tools_resources/9789241598552/en/).
- Hogan H, Healey F, Neale G, Thomson R, Vincent C, Black N. Preventable deaths due to problems in care in English acute hospitals: a retrospective case record review study. *BMJ Qual Saf.* 2012;21(9):737–45.
- Barach, P., Small DS. Reporting and preventing medical mishaps: Lessons from non-medical near miss reporting systems. *British Medical Journal* 2000; 320:753–763.
- Brown C, et al. General and specific interventions across the system and evaluation end points. *Qual Saf Health Care.* 2008;17:158–62.
- Lilford R, Chilton PJ, Hemming K, Brown C, Girling A, Barach P. Evaluating policy and service interventions: framework to guide selection and interpretation of study end points. *BMJ.* 2010;341:c4413.
- Bickler SW, Sanno-Duanda B. Epidemiology of paediatric surgical admissions to a government referral hospital in the Gambia. *Bull World Health Organ.* 2000;78:1330–6.
- Weiser TG, Regenbogen SE, Thompson KD, Haynes AB, Lipsitz SR, Berry WR, Gawande AA. An estimation of the global volume of surgery: a modelling strategy based on available data. *Lancet.* 2008;372:139–44.
- Cassera MA, Zheng B, Martinec DV, Dunst CM, Swanström LL. Surgical time independently affected by surgical team size. *Am J Surg.* 2009;198(2):216–22. doi:10.1016/j.amjsurg.2008.10.016.
- Ghaferi AA, Birkmeyer JD, Dimick JB. Hospital volume and failure to rescue with high-risk surgery. *Med Care.* 2011;49:1076–81.
- Cassin B, Barach P. Making Sense of Root Cause Analysis Investigations of Surgery-Related Adverse Events. *Surg Clin North America* 2012, 1–15, doi:10.1016/j.suc.2011.12.008.
- The National Reporting and Learning System (NRLS). <https://report.nrls.nhs.uk/nrlsreporting/>
- de Vries EN, Ramrattan MA, Smorenburg SM, Gouma DJ, Boermeester MA. The incidence and nature of in-hospital adverse events: a systematic review. *Qual Saf Health Care.* 2008;17(3):216–23.
- WHO Safe Surgery Programme. <http://www.who.int/patientsafety/safesurgery/en/>.
- Reichman DE, Greenberg JA. Reducing surgical site infections: a review. *Rev Obstet Gynecol.* 2009;2(4): 212–21.
- Seiden, S., Barach, P. Wrong-side, wrong procedure, and wrong patient adverse events: Are they preventable? *Archives of Surgery*, 2006;141:1–9.
- Cima RR, Kollengode A, Garnatz J, et al. Incidence and characteristics of potential and actual retained foreign object events in surgical patients. *J Am Coll Surg.* 2008;207(1):80–7.
- Shojania KG, Duncan BW, McDonald KM, Wachter RM. A Critical Analysis of Patient Safety Practices. Evidence Report/Technology Assessment, No. 43. Report prepared for the Agency for Healthcare Research and Quality, Contract No. 290-97-0013. Prepared by: University of California at San Francisco (UCSF)-Stanford University Evidence-based Practice Center. <http://archive.ahrq.gov/clinic/ptsafety/>.
- Shekelle PG, Wachter RM, Pronovost P et al. Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Comparative Effectiveness Review No. 211. (Prepared by the Southern California-RAND Evidence-based Practice Center under Contract No.290-2007-10062-I.) AHRQ Publication No. 13-E001-EF. Rockville: Agency for Healthcare Research and Quality. March 2013. [www.ahrq.gov/research/findings/evidence-based-reports/ptsafetyuptp.html](http://www.ahrq.gov/research/findings/evidence-based-reports/ptsafetyuptp.html)
- Sanchez J, Barach P. High Reliability Organizations and Surgical Microsystems: Re-engineering Surgical Care. *Surgical Clinics of North America*, 02/2012; 92(1):1–14. DOI: 10.1016/j.suc.2011.12.005.
- Taylor N, Clay-Williams R, Hogden E, Braithwaite J, Groene O. High performing hospitals: a qualitative systematic review of associated factors and practical strategies for improvement. *BMC Health Serv Res.* 2015;15:244.
- Secanell M, Groene O, Arah OA, Lopez MA, Kutryba B, Pfaff H, Klazinga N, Wagner C, Kristensen S, Bartels PD, Gareil P, Bruneau C, Escoval A, França M, Mora N, Suñol R, DUQuE Project Consortium. Deepening our understanding of quality improvement in Europe (DUQuE): overview of a study of hospital quality management in seven countries. *Int J Qual Health Care.* 2014;26 Suppl 1:5–15.
- Sunol R, Wagner C, Arah OA, Kristensen S, Pfaff H, Klazinga N, Thompson CA, Wang A, DerSarkissian M, Bartels P, Michel P, Groene O, DUQuE Project Consortium. Implementation of departmental quality strategies is positively associated with clinical practice: results of a multicenter study in 73 hospitals in 7 European countries. *PLoS One.* 2015;10(11):e0141157.
- Kringos DS, Sunol R, Wagner C, Mannion R, Michel P, Klazinga NS, Groene O, DUQuE Consortium. The influence of context on the effectiveness of hospital quality improvement strategies: a review of systematic reviews. *BMC Health Serv Res.* 2015;15:277.
- Groene O, Kringos D, Sunol R for the DUQUE Consortium. Seven strategies to improve the quality and safety of hospitals. [http://www.duque.eu/uploads/ENG2\\_28jan%2015%20Erasmus%20Seven.pdf](http://www.duque.eu/uploads/ENG2_28jan%2015%20Erasmus%20Seven.pdf).
- Yao GL, Novielli N, Manaseki-Holland S, Chen FY, Klink van der M, Barach P, Chilton P, Lilford R. Evaluation of a predevelopment service delivery

- intervention: an application to improve clinical handovers. *BMJ Qual Saf.* 2012; 21(s1): i29–38.
27. Shojania KG, Thomas EJ. Trends in adverse events over time: why are we not improving? *BMJ Qual Saf.* 2013;22(4):273–7. doi:[10.1136/bmjqs-2013-001935](https://doi.org/10.1136/bmjqs-2013-001935).
  28. Sunol R, Wagner C, Arah OA, Shaw CD, Kristensen S, Thompson CA, Dersarkissian M, Bartels PD, Pfaff H, Secanell M, Mora N, Vlcek F, Kutaj-Wasikowska H, Kutryba B, Michel P, Groene O, DUQuE Project Consortium. Evidence-based organization and patient safety strategies in European hospitals. *Int J Qual Health Care.* 2014;26 Suppl 1:47–55.
  29. Taylor A, Neuburger J, Walker K, Cromwell D, Groene O. How is feedback from national clinical audits used? Views from English National Health Service trust audit leads. *J Health Serv Res Policy.* 2016;21(2):91–100.
  30. Barach, P; Pahl R, Butcher A. Actions and Not Words, Randwick, NSW: JBara Innovations for HQIP, National Health Service, London, 2013.
  31. Bottle A, Aylin P. Application of AHRQ patient safety indicators to English hospital data. *Qual Saf Health Care.* 2009;18:303–8.
  32. Aylin P, Tanna S, Bottle A, Jarman B. How often are adverse events reported in English hospital statistics? *BMJ.* 2004;329(7462):369.
  33. Quan H, Drösler S, Sundararajan V, Wen E, Burnand B, Couris CM, Halfon P, Januel JM, Kelley E, Klazinga N, Luthi JC, et al. Adaptation of AHRQ patient safety indicators for use in ICD-10 administrative data by an International Consortium. In: Henriksen K, Battles JB, Keyes MA, Grady ML, editors. *Advances in patient safety: new directions and alternative approaches, Assessment, vol. 1.* Rockville: Agency for Healthcare Research and Quality; 2008.
  34. Zhan C, Miller MR. Administrative data based patient safety research: a critical review. *Qual Saf Health Care.* 2003;21 Suppl 2:ii58–63.
  35. Nolte E, Roland M, Guthrie S, Brereton L. Preventing emergency readmissions to hospital. A scoping review. Cambridge: RAND; 2012.
  36. Fischer C, Lingsma H, Hardwick R, Cromwell DA, Steyerberg E, Groene O. Risk adjustment models for short-term outcomes after surgical resection for oesophagogastric cancer. *Br J Surg.* 2016;103(1):105–16.
  37. Barach P, Lipshultz S. The benefits and hazards of publicly reported quality outcomes. Progress in in *Pediatric Cardiology* (2016), pp. 45–49, DOI information: [10.1016/j.ppedcard.2016.06.001](https://doi.org/10.1016/j.ppedcard.2016.06.001).
  38. Walker K, Neuburger J, Groene O, Cromwell DA, van der Meulen J. Public reporting of surgeon outcomes: low numbers of procedures lead to false complacency. *Lancet.* 2013;382(9905):1674–7.
  39. Wagner C, Thompson CA, Arah OA, Groene O, Klazinga NS, Dersarkissian M, Suñol R, DUQuE Project Consortium. A checklist for patient safety rounds at the care pathway level. *Int J Qual Health Care.* 2014;26 Suppl 1:36–46.
  40. Johnson, J and Barach, P. *Quality Improvement Methods to Study and Improve the Process and Outcomes of Pediatric Cardiac Surgery.* Progress in *Pediatric Cardiology.* 2011;32:147–153.

Surgical Patient Care

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