ANESTHESIOLOGY
Trusted Evidence: Discovery to Practice

Perspectives from Journal Leaders

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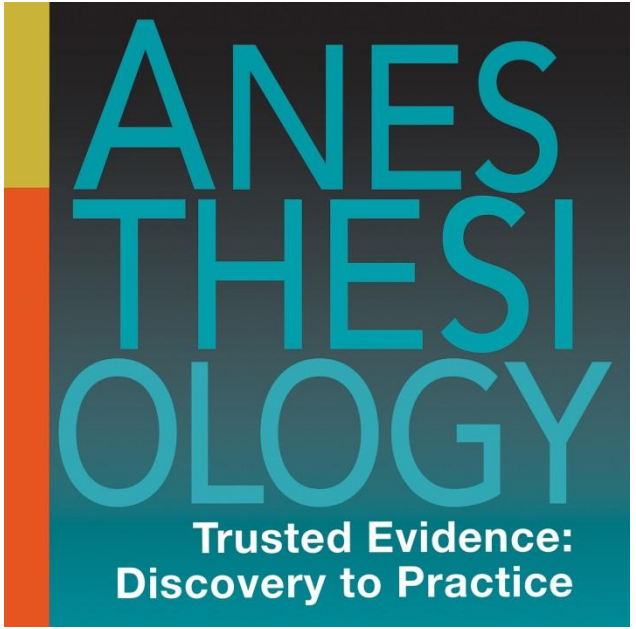
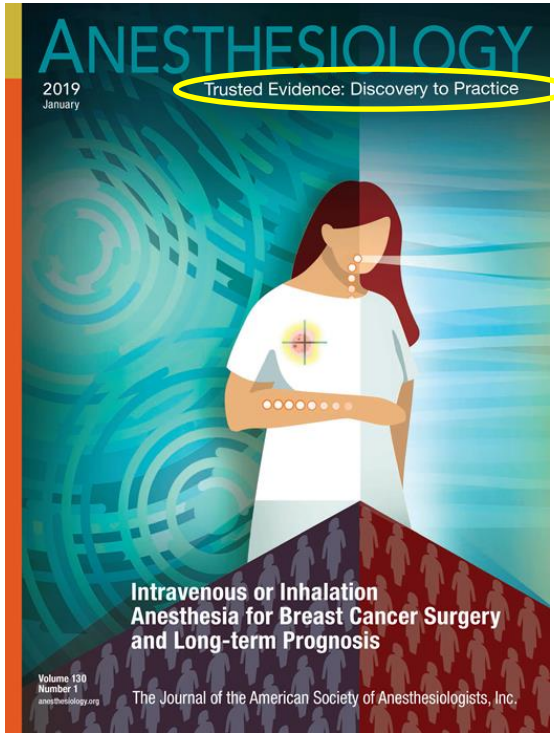


Trusted Evidence: Discovery to Practice



Trusted Evidence

- Readers: Peer-reviewed content the most important source of information to support clinical practice or inform research
- Most common reason to read ANESTHESIOLOGY? Authoritative source of clinical practice & research information
- Highest rated ANESTHESIOLOGY attribute: Credibility of content

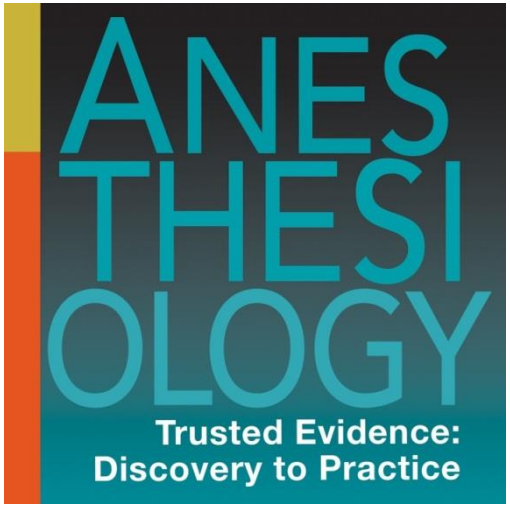
Discovery to practice

Interests and content of ANESTHESIOLOGY

- *Span* from discovery to practice
- *Translate* discovery into practice
- *Influence* science from discovery to practice

Trusted Evidence:

- Transparency of reporting
- Peer review imperative
- Soundness of results
- Validity of conclusions
- Scholarly integrity
- Richness of content
- Reach and readability



Original investigations

- Perioperative Medicine
- Critical Care Medicine
- Pain Medicine

Reporting of Observational Research in ANESTHESIOLOGY: The Importance of the Analysis Plan

James C. Eisenach, M.D., Sachin Kheterpal, M.D., Timothy T. Houle, Ph.D.

Anesthesiology 2016;124:998–1000

Concepts:

1. Because of many threats to interpretations of observational research, a key element is development of a carefully crafted plan of analysis that prospectively defines variables (primary outcome, exposure variables, confounders), subgroup analyses, sensitivity analyses, selection and adjustment methods, to reduce impact of bias on interpretation of results
2. Development of the analysis plan is best done before examination of the data, when the study is being designed
3. Failure to pre-specify an analysis plan can lead to unwanted consequences

Reporting of Observational Research in ANESTHESIOLOGY: The Importance of the Analysis Plan

James C. Eisenach, M.D., Sachin Kheterpal, M.D., Timothy T. Houle, Ph.D.

Anesthesiology 2016;124:998–1000

Changes in Journal policy regarding observational studies:

1. Strongly encourage authors of observational studies to develop a statistical analysis plan before accessing data
2. Strongly encourage reviewers and readers to consider these plans when evaluating the reliability of their conclusions
3. Require going forward that authors transparently report in the article whether an analysis plan was developed before accessing data

Observations and Observational Research

Evan D. Kharasch, M.D., Ph.D.

Anesthesiology 2019;131:1–4

Concepts:

- Author participation in the 2016 requirements and their enforcement has been inconsistent
- Observational research continues to evolve and grow; so too should expectations of readers in transparency of methods & reporting

Observations and Observational Research

Evan D. Kharasch, M.D., Ph.D.

Anesthesiology 2019;131:1–4

Policy:

- Observational studies should report according to the STROBE group guidelines (Strengthening Reporting of Observational Studies in Epidemiology)
- ANESTHESIOLOGY will require explicit statement in manuscripts of whether a data analysis and statistical plan was defined before accessing data

Observations and Observational Research

Evan D. Kharasch, M.D., Ph.D.

Anesthesiology 2019;131:1–4

Methods section must state: *A data analysis and statistical plan was*

(1) written and posted on a publically accessible server (ClinicalTrials.gov or other) before data were accessed,

(2) written and filed with private entity (IRB or other) before data were accessed,

(3) written, date-stamped (permanent dated electronic signature), and recorded in the investigators' files before data were accessed, or

(4) written after the data were accessed

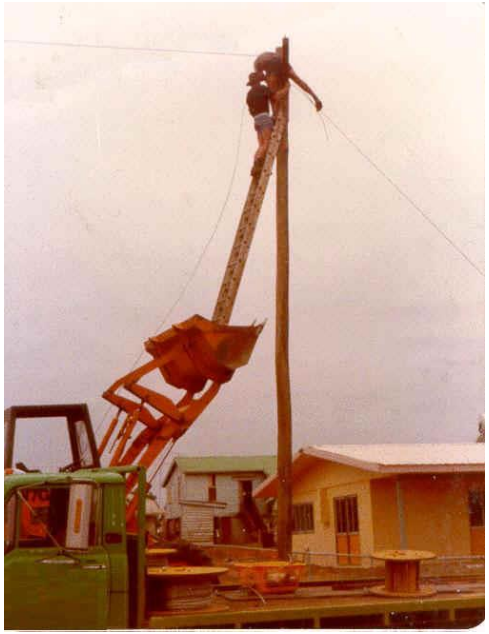
If there was an *a priori* data analysis and statistical plan (#1-3), authors are requested and strongly encouraged to include the plan as supplemental digital content at the time of initial manuscript submission

Observations and Observational Research

Evan D. Kharasch, M.D., Ph.D.

Anesthesiology 2019;131:1–4

- ANESTHESIOLOGY will not presently require registration of observational studies
- Observational studies occasionally may need to add *post hoc* analyses. Such analyses outside the *a priori* analysis plan must be interpreted appropriately, and can occasionally lead to important discoveries
- However, authors must transparently explain the approach and justify why it was done



The NEW ENGLAND JOURNAL of MEDICINE

EDITORIALS

New Guidelines for Statistical Reporting in the *Journal*

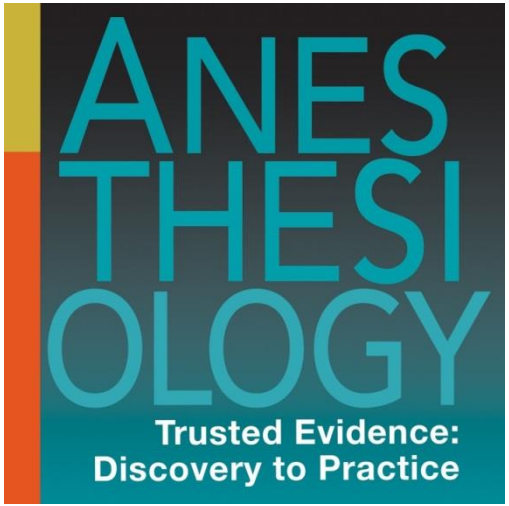
July 18, 2019

Observational studies:

- Must submit the prespecified SAP with the manuscript
- Must deposit SAPs in an online repository
- Must use accepted prespecified methods to control false discovery
- If no prespecified analysis plan exists, Methods section should provide the planned method of analysis

Trusted Evidence:

- Transparency of reporting
- Peer review imperative
- Richness of content
- Soundness of results
- Validity of conclusions
- Reach and readability



Peer review imperative

- Title
- Abstract
  - Hypothesis
  - Purpose
  - Methods
  - 1°/2° outcome
  - Results
  - ~~Narrative~~
  - Conclusions
- Statistical analysis
- ~~False precision~~
- ~~Nonstandard abbreviations~~
- ~~Spin~~

- Speed & quality of peer review
- Author participation
- Minimize revisions

Perspectives on Multicenter Pragmatic and Observational Research: *British Journal of Anaesthesia*

Hugh C Hemmings Jr MD PhD FRCA
Editor-in-Chief, *British Journal of Anaesthesia*
Senior Associate Dean for Research
Professor and Chair of Anesthesiology
Weill Cornell Medicine, Cornell University
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10.18.2019

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Declaration of interests

- Editor-in Chief, *British Journal of Anaesthesia*
- Research funding from the National Institutes of Health, Instrumentation Laboratories
- Consultant for Elsevier (Clinical Key)
- MPOG Executive Board Member

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British Journal of Anaesthesia

Publishing high-impact original work in all branches of anaesthesia, critical care medicine, pain medicine and perioperative medicine

Editor-in-Chief:
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*Journal Citation Reports (Clarivate Analytics, 2019)

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Observational research in the BJA

1. Prospective audits
2. Recent observational papers from the BJA: Retrospective analysis of large data sets

UK National Audit Project

- Royal College of Anaesthetists NAP program since 2003
- Last four have had significant clinical impact in anesthesia:
  - **NAP3: major complications of central neuraxial blocks (2009)**
  - **NAP4: serious adverse events related to airway management in the OR, ICU and ED (2011)**
  - **NAP5: awareness under general anesthesia (2014)**
  - **NAP6: perioperative anaphylaxis (2018)**
  - ***NAP7: perioperative cardiac arrest (ongoing)***
- Consist of: baseline survey as benchmark, activity survey of current practice, high fidelity national registry of rare events over a year, analysis and recommendations

Audits as observational research and implementation science

- Research across the translational spectrum.
- Rigorous audits fall under the umbrella of translational research (T2-T4)
  - T2 - High quality surveys and observational studies
  - T3 – Dissemination and implementation of findings from audit process
  - T4 – Guidelines and standards

BJA
British Journal of Anaesthesia

Volume 121, Number 1, July 2018

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EDITORIALS

Auditing the national audit projects: impact and implementation

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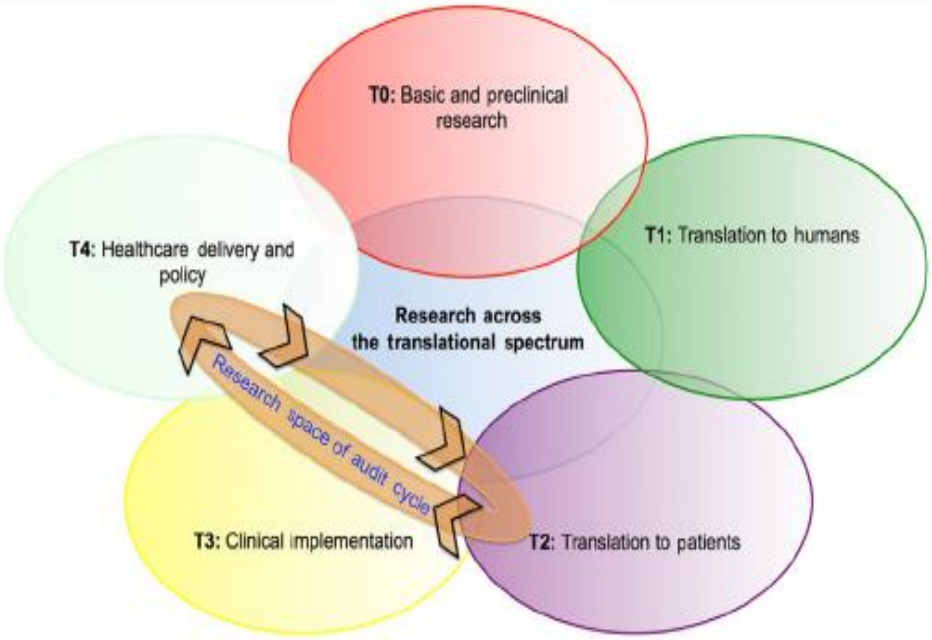
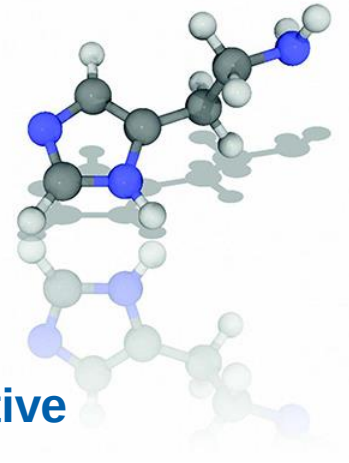
[1]Department of Anesthesiology, Washington University School of Medicine, St. Louis, MO, USA and [2]Department of Anaesthesia and Perioperative Medicine, Alfred Hospital and Monash University, Melbourne, Victoria, Australia



NAP6 series



Special Issue on Perioperative Anaphylaxis July 2019

- **Pros: national coverage of UK with involvement of most clinicians**
- **Cons: under-reporting of complications, impact on changes in practice (*post hoc ergo propter hoc* fallacy); NHS conducive and not available in other countries**

Anaesthesia, surgery, and life-threatening allergic reactions: protocol and methods of the 6th National Audit Project (NAP6) of the Royal College of Anaesthetists

T. M. Cook[1,2,3,*], N. J. N. Harper[3,4,5], L. Farmer[3], T. Garcez[6], K. Floss[7], S. Marinho[8], H. Torevell, A. Warner[9], N. McGuire[10], K. Ferguson[11], J. Hitchman[3], W. Egner[12], H. Kemp[13], M. Thomas[14], D. N. Lucas[15], S. Nasser[16], S. Karanam[17], K.-L. Kong[17], S. Farooque[18], M. Bellamy[19], A. McGlennan[20] and S. R. Moonesinghe[21]

Cross-sectional study of perioperative drug and allergen exposure in UK practice in 2016: the 6th National Audit Project (NAP6) Allergen Survey

S. Marinho[1], H. Kemp[2], T. M. Cook[3,4,5,*], L. Farmer[6], S. Farooque[7], D. N. Lucas[8], T. Garcez[9], K. Floss[10], H. Torevell, M. Thomas[11], A. Warner[12], J. Hitchman[6], K. Ferguson[13], W. Egner[14,15], S. Nasser[16], S. Karanam[17], K.-L. Kong[17], N. McGuire[18], M. Bellamy[19,20] and N. J. N. Harper[21,22,6]

Anaesthesia, surgery, and life-threatening allergic reactions: management and outcomes in the 6th National Audit Project (NAP6)

N. J. N. Harper[1,2,3], T. M. Cook[4,5,6,*], T. Garcez[7], D. N. Lucas[8], M. Thomas[9], H. Kemp[10], K.-L. Kong[11], S. Marinho[12], S. Karanam[11], K. Ferguson[13], J. Hitchman[3], H. Torevell, A. Warner[14], W. Egner[15,16], S. Nasser[17], N. McGuire[18], M. Bellamy[19,20], K. Floss[21], L. Farmer[3] and S. Farooque[22]

An observational national study of anaesthetic workload and seniority across the working week and weekend in the UK in 2016: the 6th National Audit Project (NAP6) Activity Survey

H. Kemp[1], S. Marinho[2], T. M. Cook[3,4,5,*], L. Farmer[5], M. Bellamy[6,7], W. Egner[8,9], S. Farooque[10], K. Ferguson[11], K. Floss[12], T. Garcez[13], S. Karanam[6], J. Hitchman[14], K.-L. Kong[14], N. McGuire[15], S. Nasser[16], D. N. Lucas[17], M. Thomas[18], H. Torevell, A. Warner[19] and N. J. N. Harper[6,2,20]

BJA British Journal of Anaesthesia

NAP6 series

Anaesthesia, surgery, and life-threatening allergic reactions: protocol and methods of the 6th National Audit Project (NAP6) of the Royal College of Anaesthetists

T. M. Cook[1,2,3,*], N. J. N. Harper[3,4,5], L. Farmer[3], T. Garcez[6], K. Floss[7], S. Marinho[8], H. Torevell, A. Warner[9], N. McGuire[10], K. Ferguson[11], J. Hitchman[3], W. Egner[12], H. Kemp[13], M. Thomas[14], D. N. Lucas[15], S. Nasser[16], S. Karanam[17], K.-L. Kong[17], S. Farooque[18], M. Bellamy[19], A. McGlennan[20] and S. R. M[21]

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N. J. N. Harper[6,2,20]

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BJA British Journal of Anaesthesia

Anaesthesia, surgery, and life-threatening allergic reactions: epidemiology and clinical features of perioperative anaphylaxis in the 6th National Audit Project (NAP6)

N. J. N. Harper[1,2,3], T. M. Cook[4,5,6,*], T. Garcez[7], L. Farmer[3], K. Floss[8], S. Marinho[9], H. Torevell, A. Warner[10], K. Ferguson[11], J. Hitchman[3], W. Egner[12,13], H. Kemp[14], M. Thomas[15], D. N. Lucas[16], S. Nasser[17], S. Karanam[18], K.-L. Kong[18], S. Farooque[19], M. Bellamy[20,21] and N. McGuire[22]

[1]Manchester University NHS Foundation Trust, Manchester, UK, [2]Manchester Academic Heath Science Centre, University of Manchester, Manchester, UK, [3]Royal College of Anaesthetists, London, UK, [4]Royal United Hospital, Bath, UK, [5]University of Bristol School of Medicine, Bristol, UK, [6]Health Services Research Centre, Royal College of Anaesthetists, London, UK, [7]Manchester University NHS Foundation Trust, Manchester, UK (United Kingdon Fatal Anaphylaxis Register), [8]Oxford University Hospitals NHS Trust, Oxford, UK (Royal Pharmaceutical Sociey of Great Britain), [9]Manchester University NHS Foundation Trust, Manchester, UK (British Society for Allergy and Clinical Immunology), [10]Allergy UK, London, UK, [11]Aberdeen Royal Infirmary, Aberdeen, UK (Association of Anaesthetists of Great Britain and Ireand), [12]Sheffield Teaching Hospitals NHS Trust, Sheffield, UK (Royal College of Physicians/Royal College of Pathologists Joint Committee on Immunology and Allergy), [13]Department of Infection, Immunity and Cardiovascular Disease, University of Sheffield, Sheffield, UK, [14]Imperial College London, UK (Research and Audit Federation of Trainees), [15]Great Ormond Street Hospital, London, UK (Association of Paediatric Anaesthetists of Great Britian and Ireland), [16]Northwick Park Hospital, Harrow, UK (Obstetric Anaesthetists' Association), [17]Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK (British Society for Allergy and Clinical Allergy), [18]Sandwell and West Birmingham NHS Trust, Birmingham, UK, [19]Imperial College Healthcare NHS Trust, London, UK, [20]Leeds Teaching Hospitals NHS Trust, Leeds, UK (Faculty of Intensive Care Medicine), [21]Leeds University, Leeds, UK and [22]Medicines and Healthcare products Regulatory Agency, London, UK

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Special Article

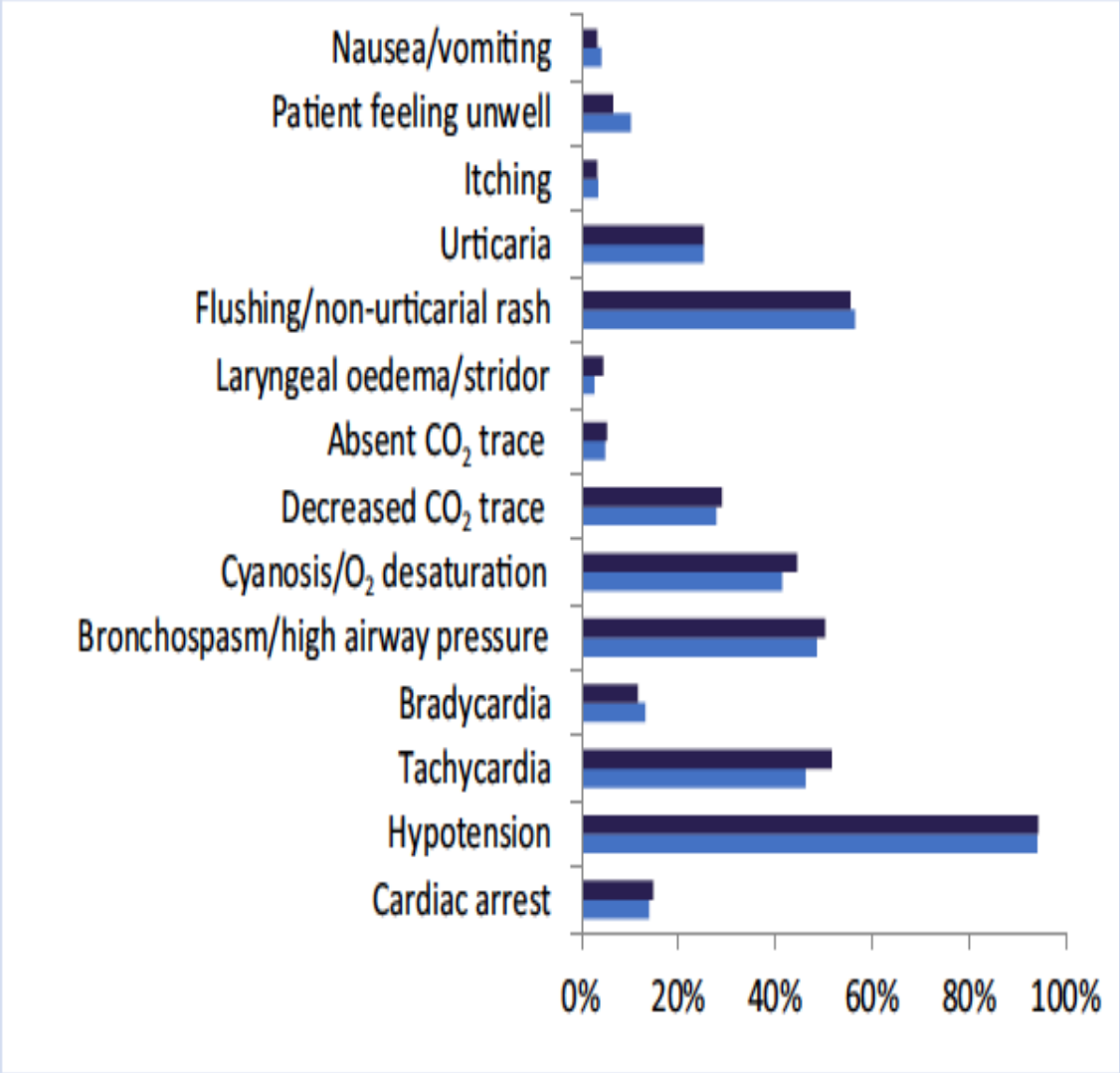

Fig 4. Clinical features (%) present at any time during Grades 3–5 perioperative anaphylaxis: all

Table 1 The 199 identified culprit agents in 192 cases of anaphylaxis in NAP6.

	Definite	Probable	Total
Agents by class			
Antibiotics	67	27	94
Neuromuscular blocking agents	49	16	65
Chlorhexidine	14	4	18
Patent Blue dye	8	1	9
Other agents	10	3	13
All	148	51	199
Antibiotics			
Co-amoxiclav	38	8	46
Teicoplanin	21	15	36
Cefuroxime	2	2	4
Gentamicin	1	2	3
Flucloxacillin	2	0	2
Piperacillin and tazobactam	1	0	1
Vancomycin	1	0	1
Metronidazole	1	0	1
Neuromuscular blocking agents			
Rocuronium	21	6	27
Atracurium	14	9	23
Succinylcholine	13	1	14
Mivacurium	1	0	1
Antiseptics and dyes			
Chlorhexidine	14	4	18
Patent Blue dye	8	1	9
Other agents			
Gelatin	3	0	3
Blood products	2	0	2
Ondansetron	1	1	2
Sugammadex	1	0	1
Ibuprofen	1	0	1
Propofol	1	0	1
Protamine	1	0	1
Aprotinin	0	1	1
Heparin	0	1	1

Retrospective analysis of large data sets

- Observational epidemiological studies
- Move toward preplanned analyses
- Mostly hypothesis generating

BJA Instructions:
Observational studies: STROBE statement reporting checklists **must** be provided. Please check the STROBE statement website for up-to-date information concerning specific study types, including observational studies in epidemiology, genetic association studies, cohort studies, case-control studies, and cross-sectional studies.

British Journal of Anaesthesia, 120 (5): 1090–1102 (2018)

doi: 10.1016/j.bja.2017.12.044
Advance Access Publication Date: 9 March 2018
Quality and patient safety

Association between intraoperative opioid administration and 30-day readmission: a pre-specified analysis of registry data from a healthcare network in New England

D. R. Long[1], A. L. Lihn[1,2], S. Friedrich[1], F. T. Scheffenbichler[1], K. C. Safavi[1], S. M. Burns[1], J. C. Schneider[3], S. D. Grabitz[1], T. T. Houle[1] and M. Eikermann[4,5,*]

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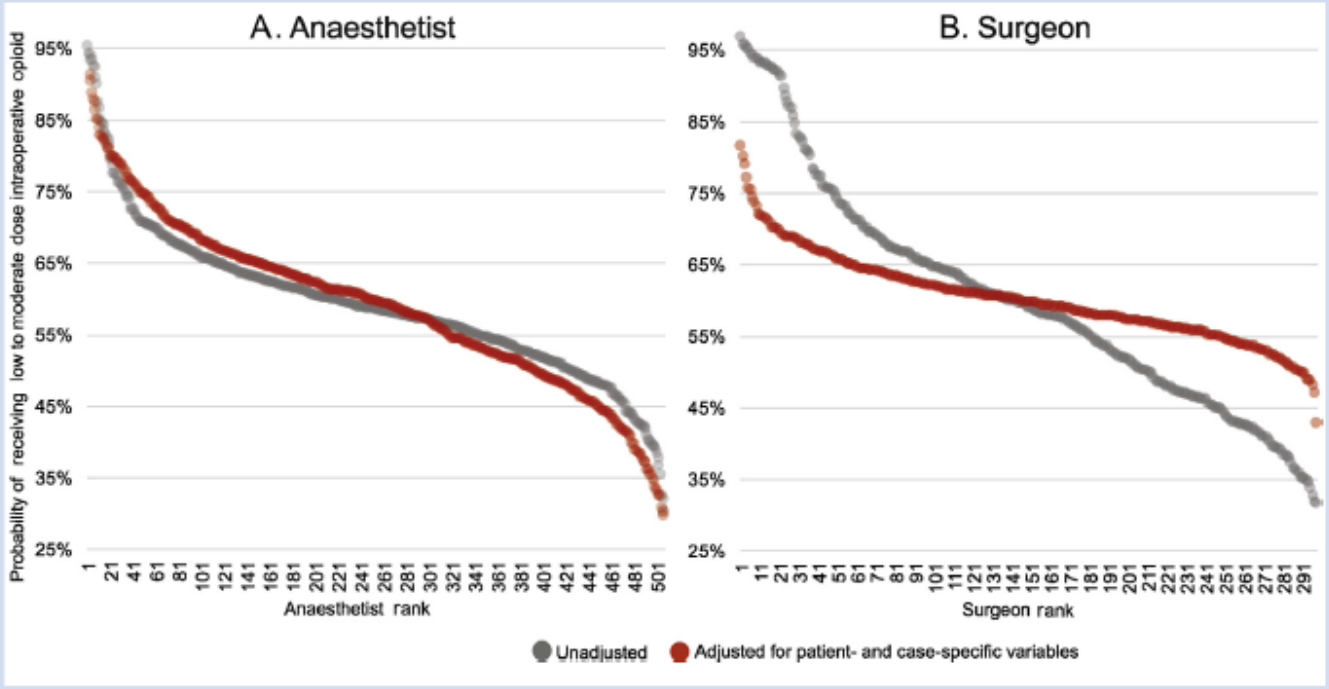

Fig 4. Provider-level practice variation in intraoperative opioid dosing. Opioid administration practices ranged widely across practitioners within our cohort. (A) Individual anaesthetists are represented as a single point on the horizontal axis with the vertical axis showing the individual probability of that anaesthetist administering an opioid dose in the low to moderate range (quintile 1, 2, or 3) based on historic practice patterns. A small number of practitioners (left) consistently utilise conservative opioid doses during surgery, whilst another group (right) regularly administer higher doses. A similar distribution is observed both before (grey circles) and after (red circles) propensity-matched adjustment for factors that may influence opioid administration (including procedure duration, procedural severity score, pre-operative opioid use, admission status, surgical service, BMI, weight, depth of anaesthesia, and use of neuraxial techniques). A parallel analysis of variation according to (B) primary surgeon indicates that much of the heterogeneity across surgical practice is related to differences in case mix. After adjustment for the same patient- and case-specific factors, the range of variability attributable to the influence of the surgeon (60.4+/−6.0%) is relatively small compared with that of the individual anaesthetist (59.1+/−11.6%).

BJA EDUCATION

Abstract

Background: The use of intraoperative opioids may influence the rate of postoperative complications. This study evaluated the association between intraoperative opioid dose and the risk of 30-day hospital readmission.

Methods: We conducted a pre-specified analysis of existing registry data for 153 902 surgical cases performed under general anaesthesia at Massachusetts General Hospital and two affiliated medical centres. We examined the association between total intraoperative opioid dose (categorised in quintiles) and 30-day hospital readmission, controlling for several patient-, anaesthetist-, and case-specific factors.

Results: Compared with low intraoperative opioid dosing [quintile 1, median (inter-quartile range): 8 (4–9) mg morphine equivalents], exposure to high-dose opioids during surgery [quintile 5: 32 (27–41) equivalents] is an independent predictor of 30-day readmission [odds ratio (OR) 1.15 (95% confidence interval 1.07–1.24); $P<0.001$]. Ambulatory surgery patients receiving high opioid doses were found to have the greatest adjusted risk of readmission (OR 1.75; $P<0.001$) with a clear dose–response effect across quintiles (P for trend <0.05), and were more likely to be readmitted early (postoperative days 0–2 *vs* 3–30; $P<0.001$). Opioid class modified the association between total opioid dose and readmission, with longer-acting opioids demonstrating a stronger influence ($P<0.001$). We observed significant practice variability across individual anaesthetists in the utilisation of opioids that could not be explained by patient- and case-specific factors.

Conclusions: High intraoperative opioid dose is a modifiable anaesthetic factor that varies in the practice of individual anaesthetists and affects postoperative outcomes. Conservative standards for intraoperative opioid dosing may reduce the risk of postoperative readmission, particularly in ambulatory surgery.

Keywords: anaesthesia; analgesics; general; opioid; patient readmission

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doi: 10.1016/j.bja.2017.08.002
Advance Access Publication Date: 23 November 2017
Quality and Safety

The surgical safety checklist and patient outcomes after surgery: a prospective observational cohort study, systematic review and meta-analysis

T.E.F. Abbott[1], T. Ahmad[1], M.K. Phull[2], A.J. Fowler[3], R. Hewson[2], B.M. Biccard[4], M.S. Chew[5], M. Gillies[6] and R.M. Pearse[1,*], for the International Surgical Outcomes Study (ISOS) group[a]

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[a] Complete details for the collab authors are available in Supplementary data.

Abstract

Background: The surgical safety checklist is widely used to improve the quality of perioperative care. However, clinicians continue to debate the clinical effectiveness of this tool.

Methods: Prospective analysis of data from the International Surgical Outcomes Study (ISOS), an international observational study of elective in-patient surgery, accompanied by a systematic review and meta-analysis of published literature. The exposure was surgical safety checklist use. The primary outcome was in-hospital mortality and the secondary outcome was postoperative complications. In the ISOS cohort, a multivariable multi-level generalized linear model was used to test associations. To further contextualise these findings, we included the results from the ISOS cohort in a meta-analysis. Results are reported as odds ratios (OR) with 95% confidence intervals.

Results: We included 44 814 patients from 497 hospitals in 27 countries in the ISOS analysis. There were 40 245 (89.8%) patients exposed to the checklist, whilst 7508 (16.8%) sustained ≥1 postoperative complications and 207 (0.5%) died before hospital discharge. Checklist exposure was associated with reduced mortality [odds ratio (OR) 0.49 (0.32–0.77); $P<0.01$], but no difference in complication rates [OR 1.02 (0.88–1.19); $P=0.75$]. In a systematic review, we screened 3732 records and identified 11 eligible studies of 453 292 patients including the ISOS cohort. Checklist exposure was associated with both reduced postoperative mortality [OR 0.75 (0.62–0.92); $P<0.01$; $I^2=87\%$] and reduced complication rates [OR 0.73 (0.61–0.88); $P<0.01$; $I^2=89\%$].

Conclusions: Patients exposed to a surgical safety checklist experience better postoperative outcomes, but this could simply reflect wider quality of care in hospitals where checklist use is routine.

Three examples from the November 2019 issue

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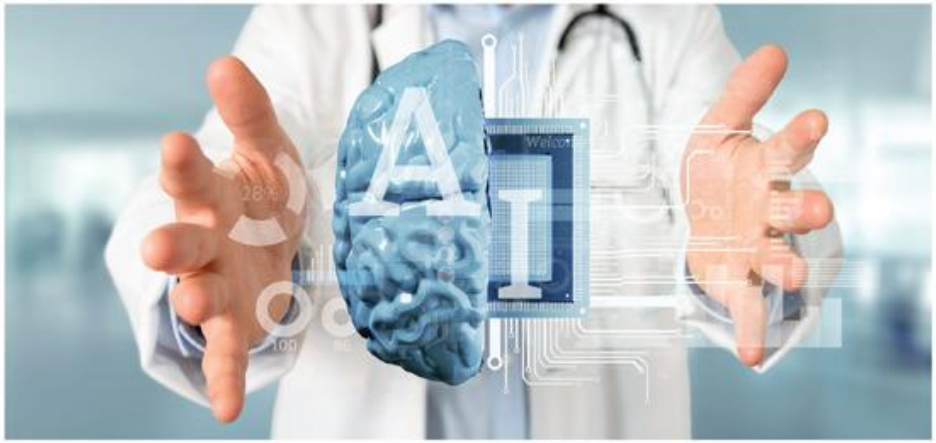

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- Outcomes after joint arthroplasty
- Preventing postoperative opioid prescriptions
- Nutrition and pain
- Preoperative hyponatraemia and perioperative mortality in children
- Emergency front of neck access
- Anaesthesiology in China

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BJA

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Quality and Patient Safety

- **Observational cohort study**
- **Large Danish registry**
- **Showed that DAH30 was as good as DAH90 in detecting compications**
- **Lower in high-risk patients**
- **More medical than surgical complications**

Days alive and out of hospital after fast-track total hip and knee arthroplasty: an observational cohort study in 16 137 patients

Christoffer C. Jørgensen[1,2,*], Pelle B. Petersen[1,2], Henrik Kehlet[1,2] on behalf of the Lundbeck Foundation Center for Fast-track Hip and Knee Replacement Collaborative Group[†]

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Abstract

Background: Days alive and out of hospital (DAH) has been proposed as a pragmatic outcome measure of surgical quality. However, there is a lack of procedure specific data or data within an optimised fast-track protocol. Furthermore, information about influence of follow-up duration and types of complications on DAH is limited.

Methods: Observational multicentre cohort study of patients undergoing fast-track total hip (THA) and knee arthroplasty (TKA). Prospective information on comorbidity and complete 90 days follow-up was undertaken through the Danish National Patient Register and chart review.

Results: For 16 137 procedures, of which 18.6% were high-risk (≥2 preoperative risk factors), the median length of stay was 2 days (inter-quartile range [IQR], 2–3), and 30- and 90-day readmission rates were 5.7% and 8.1%, respectively. Median DAH_{30} and DAH_{90} days were 27 (26–28) and 87 (85–88) *vs* 28 (27–28) and 88 (87–89) ($P<0.001$) in high-*vs* low-risk patients, respectively. The fraction with DAH ≤25 at 30 days and DAH ≤85 at 90 days was increased in high-*vs* low-risk patients: 23.3% *vs* 6.8% (odds ratio [OR]=4.16; 95% confidence interval [CI], 3.73–4.65) and 26.0% *vs* 8.6% (OR=3.75; 95% CI, 3.38–4.16). There were relatively fewer 'surgical' complications in high- *vs* low-risk patients with DAH_{30} ≤25 (14.6% *vs* 25.8%) (OR=0.49; 95% CI, 0.37–0.65) and DAH_{90} ≤85 (16.9% *vs* 31.89%) (OR=0.43; 95% CI, 0.34–0.56). About 2% of patients had readmissions, but DAH was >25 and >85 at 30 and 90 days after operation, respectively.

Conclusion: Median DAH in fast-track THA/TKA patients is 28 at 30 days and 88 at 90 days after surgery. DAH in high-risk patients was only slightly reduced compared with low-risk patients, but they have relatively more 'medical' complications.

Keywords: enhanced recovery; fast-track surgery; hip replacement; knee replacement; perioperative medicine; postoperative outcomes

BJA

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Advance Access Publication Date: 24 September 2019
Quality and Patient Safety

- **Retrospective single center analysis**
- **Association of any complication with caseload**
- **No association with anesthesiologist case volume or experience**
- **Reduced complication with surgeon case volume >50 per year**

Anaesthesia provider volume and perioperative outcomes in total joint arthroplasty surgery

Stavros G. Memtsoudis[1,2,3,4,*], Lauren A. Wilson[1], Janis Bekeris[1,2], Jiabin Liu[1,3], Lazaros Poultsides[5], Megan Fiasconaro[1] and Jashvant Poeran[6]

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Abstract

Background: While increased surgical-provider volume has been associated with improved outcomes, research regarding volume–outcome relationships within high-volume institutions and the role of anaesthesiologists is limited. Further, the effect of anaesthesia-care-team composition remains understudied. This analysis aimed to identify the impact of anaesthesiologist and surgeon volume on adverse events after total joint arthroplasties.

Methods: We retrospectively identified 40 437 patients who underwent total joint arthroplasties at a high-volume institution from 2005 to 2014. The main effects of interest were anaesthesiologist and surgeon volume and experience along with anaesthesia-care-team composition. Multivariable logistic regression models were used to evaluate three outcomes: any complication, cardiopulmonary complication, and length of stay (>5 days). Odds ratios (ORs) and 99.75% confidence intervals (CIs) were reported.

Results: Across all three models, anaesthesiologist volume and experience, and anaesthesia-care-team composition were not significant predictors. Surgeon annual case volume >50 was associated with significantly reduced odds of any complication (annual case volume: 50–149; OR: 0.80; CI: 0.66–0.98) and prolonged length of stay (OR: 0.69; CI: 0.60–0.80). Surgeon experience >20 yr was associated with significantly reduced odds of prolonged length of stay (OR: 0.85; CI: 0.75–0.95).

Conclusions: Anaesthesiologist volume and experience, and anaesthesia-care-team composition did not impact the odds of an adverse outcome, although a higher surgeon volume was associated with decreased odds of complications and prolonged length of stay. Further study is necessary to determine if these findings can be extrapolated to less specialised, lower volume surgical settings.

Keywords: anaesthesiologist; arthroplasty; outcome; perioperative; quality; surgeon; surgical volume

BJA

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Advance Access Publication Date: 23 September 2019
Quality and Patient Safety

- **Retrospective single center analysis (Wash U)**
- **Machine learning approach to predictive modeling**
- **Perioperative electronic data from > 95,000 patients split into training, validation and testing groups**
- **Deep learning model provided greater predictive power for 30-day postoperative mortality than conventional tools**

Deep-learning model for predicting 30-day postoperative mortality

Bradley A. Fritz[1,*,†], Zhicheng Cui[2,†], Muhan Zhang[2], Yujie He[2], Yixin Chen[2], Alex Kronzer[1], Arbi Ben Abdallah[1], Christopher R. King[1] and Michael S. Avidan[1]

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Abstract

Background: Postoperative mortality occurs in 1–2% of patients undergoing major inpatient surgery. The currently available prediction tools using summaries of intraoperative data are limited by their inability to reflect shifting risk associated with intraoperative physiological perturbations. We sought to compare similar benchmarks to a deep-learning algorithm predicting postoperative 30-day mortality.

Methods: We constructed a multipath convolutional neural network model using patient characteristics, co-morbid conditions, preoperative laboratory values, and intraoperative numerical data from patients undergoing surgery with tracheal intubation at a single medical centre. Data for 60 min prior to a randomly selected time point were utilised. Model performance was compared with a deep neural network, a random forest, a support vector machine, and a logistic regression using predetermined summary statistics of intraoperative data.

Results: Of 95 907 patients, 941 (1%) died within 30 days. The multipath convolutional neural network predicted post-operative 30-day mortality with an area under the receiver operating characteristic curve of 0.867 (95% confidence interval [CI]: 0.835–0.899). This was higher than that for the deep neural network (0.825; 95% CI: 0.790–0.860), random forest (0.848; 95% CI: 0.815–0.882), support vector machine (0.836; 95% CI: 0.802–870), and logistic regression (0.837; 95% CI: 0.803–0.871).

Conclusions: A deep-learning time-series model improves prediction compared with models with simple summaries of intraoperative data. We have created a model that can be used in real time to detect dynamic changes in a patient's risk for postoperative mortality.

Keywords: anaesthesiology; deep learning; machine learning; postoperative complications; risk prediction; surgery

And one more in press for December

- Retrospective single center analysis (UCLA)
- Machine learning approach to predictive modeling
- Perioperative electronic data from > 53,000 patients
- Deep learning model provided greater predictive power for in-hospital postoperative mortality than conventional tools

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BJA

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doi: 10.1016/j.bja.2019.07.030
Advance Access Publication Date: xxx
Clinical Investigation

CLINICAL INVESTIGATION

An automated machine learning-based model predicts postoperative mortality using readily-extractable preoperative electronic health record data

Brian L. Hill[1,†], Robert Brown[1,†], Eilon Gabel[2], Nadav Rakocz[1], Christine Lee[3,4], Maxime Cannesson[2], Pierre Baldi[4,15], Loes Olde Loohuis[5], Ruth Johnson[1], Brandon Jew[6], Uri Maoz[2,9,10,11,12,13], Aman Mahajan[14], Sriram Sankararaman[1,7,‡], Ira Hofer[2,*,‡] and Eran Halperin[1,2,7,8,‡]

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Abstract

Background: Rapid, preoperative identification of patients with the highest risk for medical complications is necessary to ensure that limited infrastructure and human resources are directed towards those most likely to benefit. Existing risk scores either lack specificity at the patient level or utilise the American Society of Anesthesiologists (ASA) physical status classification, which requires a clinician to review the chart.

Methods: We report on the use of machine learning algorithms, specifically random forests, to create a fully automated score that predicts postoperative in-hospital mortality based solely on structured data available at the time of surgery. Electronic health record data from 53 097 surgical patients (2.01% mortality rate) who underwent general anaesthesia between April 1, 2013 and December 10, 2018 in a large US academic medical centre were used to extract 58 preoperative features.

Results: Using a random forest classifier we found that automatically obtained preoperative features (area under the curve [AUC] of 0.932, 95% confidence interval [CI] 0.910–0.951) outperforms Preoperative Score to Predict Postoperative Mortality (POSPOM) scores (AUC of 0.660, 95% CI 0.598–0.722), Charlson comorbidity scores (AUC of 0.742, 95% CI 0.658–0.812), and ASA physical status (AUC of 0.866, 95% CI 0.829–0.897). Including the ASA physical status with the preoperative features achieves an AUC of 0.936 (95% CI 0.917–0.955).

Conclusions: This automated score outperforms the ASA physical status score, the Charlson comorbidity score, and the POSPOM score for predicting in-hospital mortality. Additionally, we integrate this score with a previously published postoperative score to demonstrate the extent to which patient risk changes during the perioperative period.

Keywords: electronic health record; hospital mortality; machine learning; perioperative outcome; risk assessment

Summary

- **BJA publishes clinical trials, data analytics, laboratory studies, systematic reviews and meta-analyses, audits, guidelines, case reports, correspondence**
- **Prospective national audits have been major drivers for practice guidelines**
- **Retrospective observational studies are being driven by large data sets provided by health system EHRs to identify associations and develop risk prediction tools by machine learning**

Thank you!

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Sunday 20th October	Time
Dr Gareth Ackland	11:45 - 14:00
Professor Hugh Hemmings	14:00 - 16:00

Monday 21st October	Time
Professor Hugh Hemmings	9:00 - 10:30
Dr Gareth Ackland	11:30 - 13:30