

Coordination of procedural equipment and supplies for the surgical set-up in the perioperative environment: A scoping review

Supplement 1: Search strategy

Search strategy applied in Joanna Briggs Institute EPD (Via OVID)

((“Surgery+” or Surgicenters or “Surgery, Operative+” or “Robotic Surgical Procedures” or “Perioperative Nursing” or “Operating Rooms” or Hospitals+ or “Health Facilities+”) and (“Disposable Equipment” or “Equipment and Supplies+” or “Prostheses and Implants+” or “Surgical Equipment and Supplies+” or “Surgical Instruments”) and (analys* or Communication+ or efficiency or economics+ or ergonomics+ or “healthcare supply chain+” or “healthcare supply chain+” or human or management+ or “materials management” or “planning techniques+” or “quality assurance” or “quality improvement” or “resource allocation+”))

Supplement 2: Eligibility criteria

Response to questions must be ‘yes’ for paper to be included.

Question	Response	
	yes	no
1. Is the paper an empirical study?		
2. Does the context/setting include surgery in the perioperative environment? • Surgery is defined as invasive dissection of human tissue, such as an incision or excision with regional, general or sedative anaesthesia for control of pain. • Perioperative environment is defined as an environmentally controlled area with one or more operating rooms to support patient procedural interventions under inhalation or other anaesthetic agents¹.		
3. Does the population include health service personnel, organisations or teams responsible for the surgical set-up?		
4. Does the source include the surgical set up / case assembly concept? • Surgical set up involves the timely coordination and organisation of single-use and reusable medical devices (RMD), biomaterials and ancillary equipment. A set-up, or case assembly, is defined as assembly of physical resources needed for a procedure and may include opening and laying out surgical set-up items within the procedural room¹. This includes surgical instruments, single-use isolation drapes, implants and ancillary medical equipment such as laparoscopic carbon dioxide insufflation devices².		
Eligible for inclusion?		

References

1. Australasian Health Infrastructure Alliance (AHIA). Australasian Health Facility Guidelines: Part B – Health Facility Briefing and Planning, 0520 – Operating Unit [Internet]. North Sydney: AHIA; 2016 [cited 2021 March 17]. Available from: https://aushfg-prod-com-au.s3.amazonaws.com/HPU_B.0520_5_0.pdf

2. McCarthy J. Sutures, needles and instruments. In: Rothrock J, McEwen D, editors. Alexander’s care of the patient in surgery. 15th ed. St. Louis: Elsevier Mosby; 2015. pp. 186–210.

Coordination of procedural equipment and supplies for the surgical set-up in the perioperative environment: A scoping review

Supplement 3: Data extraction instrument

Adapted JBI data extraction instrument

Review objectives:

- 1. to identify and map available evidence for approaches to the surgical set up
- 2. to describe factors that hinder or support the surgical set-up
- 3. to identify gaps in literature, if any, regarding the surgical set up
- 4. to determine any issues impacting the quality of current available evidence.

PCC question: For health service personnel, organisations or teams, what are the existing evidence-based approaches and factors that hinder or support the surgical set-up in the perioperative environment?

Inclusion/exclusion criteria	
Population	
Concept	
Context	
Type of evidence	
Evidence source: details and characteristics	
Citation details	
Country	
Participants (details e.g. type/age/sex/number)	
Details/results extracted from source of evidence	
Primary aim (approaches)	
Secondary aim (approaches)	
Factors that hinder the surgical set up	
Factors that support the surgical set up	
Areas for further research	

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Supplement 4: Summary of included studies

Author/s (year) Country	Study design	Study aim/s
Alfred et al. (2020) United States of America (USA)	mixed methods	Identify performance variation during decontamination of sterile reprocessing and identify areas for improvement.
Alfred et al. (2021) USA	mixed methods	Develop a comprehensive understanding of the assembly stage of sterile reprocessing.
Capra et al. (2019) USA	quality improvement	Evaluate the effect of surgical tray optimisation through surgeon consensus.
Chasseigne et al. (2018) France	observational longitudinal	Evaluate cost and reasons for wasted supplies and nurse circulator retrievals during surgery.
Cichos et al. (2017) USA	quality improvement	Evaluate the number of instruments sterilised and cost of standardised surgical instrument trays.
Cichos et al. (2019) USA	quality improvement	Assess the economic impact of optimising orthopaedic instrument trays.
Crosby et al. (2020) Canada	quality improvement	Identify time savings associated with surgical tray optimisation for ear, nose and throat (ENT) surgery.
Del Carmen León-Araujo et al. (2019) Spain	quality improvement	Assess inventory management for cardiothoracic surgeries with the implementation of StockKey® Radio Frequency Identification (RFID) Smart Cabinet.
Diamant et al. (2017) USA	observational longitudinal	Model re-usable medical device (RMD) inventory processes to predict optimal base stock level, expected service requirements and implied costs when RMDs are unavailable.
Dreyfus et al. (2019) USA	mixed methods	Examine how physician preference card planning and communication influences unplanned costs.
Dyas et al. (2018) USA	quality improvement	Streamlined instrument tray to optimise operative efficiency and cost for para/thyroid surgery.
Eiferman et al. (2015) USA	quality improvement	Management of operating room supplies with a shared-savings program returning 50 per cent of money saved to surgical divisions.
Friend et al. (2018) USA	quality improvement	Reduce waste of video-assisted thoracoscopic surgery (VATS). Design an instrument kit for sole use in VATS.
Fu et al. (2021) Canada	quality improvement	Optimise surgical trays for otolaryngology surgery and examine impacts to cost, operating room efficiency and patient safety.
Glaser et al. (2015) Germany	quasi-experimental	Analyse scrub nurses instrument descriptions from different surgical specialities, clinics and countries.
Goh et al. (2016) Singapore	quality improvement	Implement an instrument management system in video-assisted thoracoscopic surgery (TSSU)
Goldberg et al. (2019) USA	observational longitudinal	Model potential logistic and economic benefits of single-use instruments compared to traditional, re-usable instruments for video-assisted thoracoscopic surgery (TKA).

Author/s (year) Country	Study design	Study aim/s
Greene et al. (1987) USA	randomised controlled trial	Determine if procedural pack sterility is maintained when prepared and transported between two hospitals.
Guédon et al. (2016) Holland	mixed methods	Identify hazards in the delivery process of loaned orthopaedic surgical instruments and provide insight how information technology (IT) could support information availability and exchange.
Guimarães et al. (2016) Brazil	case study	Process mapping of VATS instruments.
Halton et al. (2014) Australia	observational longitudinal	Estimate the incidence and impact of unavailable instruments on surgical schedules and resource utilisation.
Harris (2019) USA	observational longitudinal	Model assignment of surgical instruments and trays to procedures to minimise unused instruments, instruments requested not assigned to a case and tray weight <30 lbs.
Hemingway et al. (2022) USA	quality improvement	Streamlining instrumentation through collaboration.
Howard et al. (1997) USA	quasi-experimental	Compare cost and operating time between streamlined operating room supply packs versus standard operating room packs for permanent central venous catheter (PCVC) placement.
Igesund et al. (2019) Norway	observational cross sectional	Map procedures for the set-up of instruments in sterile field.
Ikuma et al. (2020) USA	observational longitudinal	To evaluate efficiency of personnel activities and resource utilisation in TKA
Kirk (1986) USA	quality improvement	Determine if customised suture packs improved nursing efficiency and cost of cardiothoracic surgery.
Kumar and Shim (2006) Singapore	observational longitudinal	Model a new process of RMD distribution for ad-hoc orders and determine optimal number of health care assistants needed to deliver surgical instruments.
Levine et al. (1995) USA	quality improvement	To obtain cost containment through awareness and cost reduction, while maintaining and improving quality of care.
Lonner et al. (2021) USA	quality improvement	Assess economic impact of instrument tray optimisation for total joint arthroplasty (TJA).
Lum et al. (2019) Singapore	quality improvement	Identify theatre sterile surgical unit work processes, eliminate unnecessary workflow and achieve workload levelling.
Moerenhout et al. (2021) Switzerland	observational case control	Compare costs and operative time of patient-specific CT-based, single-use instruments versus conventional metal instruments for TKA.
Montgomery and Schneller (2007) USA	qualitative research	Analyse hospital strategies to shape physician behaviour and counter suppliers' power in purchasing physician preference items.
Mullaney, (2010) USA	quality improvement	Use lean principles to improve the process of supplying sterile instruments to the operating room.
Ngu (2010) USA	quality improvement	A multidisciplinary operating room project to control costs and efficiency of resources in arthroplasty surgery.
Nilsen (2005) USA	quality improvement	Determine appropriate operating room inventory and expense reduction initiatives to positively affect operational performance and staff member and patient satisfaction.
Palo et al. (2021) USA	quality improvement	Decrease instrument defect rates.

Author/s (year) Country	Study design	Study aim/s
Penn et al. (2012) USA	quality improvement	Reduce disposable waste for tonsillectomy surgery.
Pesigan et al. (2021) USA	quality improvement	Determine if editing surgeon preference cards reduced the volume and cost of opened and unused disposable items in urology.
Prephan (2005) USA	quality improvement	Improve instrument availability.
Ribes-Iborra et al. (2022) Spain	quality improvement	Investigate impact of 4S program in management of surgical instruments in trauma orthopaedic surgery.
Schneider et al. (2020) Brazil	mixed methods	Analyse the use of ophthalmic instruments and propose a management method.
Simon et al. (2018) USA	quality improvement	Designing standardised surgeon pick lists to decrease cost and equipment variability.
Stockert and Langerman (2014) USA	observational longitudinal	Quantify usage rate of instruments among common instrument trays across otolaryngology, plastic surgery, bariatric surgery and neurosurgery.
Tibesku et al. (2013) Switzerland	observational cohort study	Estimate the economic value of patient-matched instrumentation (PMI) compared to standard surgical instrumentation in TKA.
Tipple et al. (2021) Australia, Brazil	observational cross sectional	Evaluate the practices of management and reprocessing loaned devices.
Toor et al. (2022) USA	quality improvement	Implementation of surgical tray optimisation using Kotter's change model.
Ventimiglia et al. (2021) France	observational case control	Assess if single use flexible ureteroscopes used in complex endourological cases would prevent breakages and increase longevity versus re-usable flexible ureteroscope.
Wannemuehler et al. (2015) USA	quality improvement	A lean six sigma (LSS) pre-/post-intervention study to eliminate non-value-added instruments through surgeon consensus for adenotonsillectomy surgery.

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Supplement 5: Summary of critical appraisal

Quality Improvement Minimum Quality Criteria Set (QI-MQCS)¹

Capra 2019*	Cichos 2017	Cichos 2019	Crosby 2020*	DelCarmen 2019	Dyas 2018	Eiferman 2015	Friend 2018	Fu 2021*	Goh 2016	Hemmingway et al. 2022	Kirk 1986	Levine 1995	Lonner 2021	Lum 2019	Mullaney 2010	Nilsen 2005	Ngu 2010	Palo 2021*	Penn 2012	Pesigan 2021*	Prephan 2005	Ribes-Iborra et al. 2022	Simon 2018	Toor et al. 2022	Wannemuehler 2015	
																										1. Organisational problem, reason, or motivation for intervention
																										2. Rationale linking the intervention to its expected effects
																										3. Change in organisational or provider behaviour
																										4. Demographics or basic characteristics of the organisation
																										5. Temporary activities to introduce changes
																										6. Study design and comparator
																										7. Information about the comparator care processes
																										8. Data sources and outcome definition
																										9. Timing of intervention and evaluation
																										10. Adherence to the intervention
																										11. Patient health-related outcomes
																										12. Barriers and facilitators to readiness
																										13. Penetration/reach of the intervention
																										14. Sustainability of the intervention
																										15. Ability to be spread or replicated
																										16. Interpretation of the evaluation

NOTE: * Study acknowledged use of reporting guideline

	Criterion clearly observed
	Criterion not clear, or uncertain
	Criterion not met

1. Hempel S, Shekelle PG, Liu JL, Sherwood Danz M, Foy R, Lim Y-W et al. Development of the quality improvement minimum quality criteria set (QI-MQCS): A tool for critical appraisal of quality improvement intervention publications [Internet]. BMJ Qual Saf. 2015[cited 2023 Dec 1];24(12):796–804. DOI: 10.1136/bmjqs-2014-003151

Mixed Method Appraisal Tool – Quantitative Descriptive²

Chasseigne 2018	Diamant 2016	Goldberg 2019	Halton 2014	Harris 2019	Igesund 2019	Ikuma 2020	Kumar & Shim 2006	Moerenhout 2021	Stockert 2014	Tiple et al. 2021	Tibesku 2013	Ventimiglia et al. 2021	
													1. Are the research questions clear?
													2. Do the collected data allow to address the research questions?
													3. Is the sampling strategy relevant to address the research question?
													4. Is the sample representative of the target population?
													5. Are the measurements appropriate?
													6. Is the risk of nonresponse bias low?
													7. Is the statistical analysis appropriate to answer the research question?

Criterion clearly observed

Criterion not clear, or uncertain

Criterion not met

2. Hong QN, Pluye P, Fabregues S, Bartlett G, Boardman F, Cargo M et al. Mixed Method Appraisal Tool (MMAT) Version 2018 [Internet]. Montreal: McGill University; 2018 [cited 2023 Dec 1]. Available from: http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf

Mixed Method Appraisal Tool - Mixed Methods³

Alfred et al., 2020	Alfred et al., 2021	Guédon et al., 2016	Schneider et al., 2020	Dreyfus et al. 2019	
					1. Are there clear research questions?
					2. Do the collected data allow to address the research questions?
					3. Is there an adequate rationale for using a mixed methods design to address the research question?
					4. Are the different components of the study effectively integrated to answer the research question?
					5. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
					6. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed
					7. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Criterion clearly observed

Criterion not clear, or uncertain

Criterion not met

3. Hong QN, Pluye P, Fabregues S, Bartlett G, Boardman F, Cargo M et al. Mixed Method Appraisal Tool (MMAT) Version 2018 [Internet]. Montreal: McGill University; 2018 [cited 2023 Dec 1]. Available from: http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf