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New and Updated Cochrane Systematic Reviews

Laparoscopic surgical box model training for surgical trainees with limited prior laparoscopic experience
Online Publication Date: March 2014

Laparoscopic surgical box model training for surgical trainees with no prior laparoscopic experience
Online Publication Date: January 2014

Virtual reality training for surgical trainees in laparoscopic surgery
Online Publication Date: August 2013

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1. Title: A systematic review of surgical skills transfer after simulation-based training: Laparoscopic cholecystectomy and endoscopy
   Citation: Annals of Surgery, February 2014, vol./is. 259/2(236-248), 0003-4932;1528-1140 (February 2014)
   Language: English
   Abstract: OBJECTIVE: A systematic review to determine whether skills acquired through simulation-based training transfer to the operating room for the procedures of laparoscopic cholecystectomy and endoscopy. BACKGROUND: Simulation-based training assumes that skills are directly transferable to the operation room, but only a few studies have investigated the effect of simulation-based training on surgical performance. METHODS: A systematic search strategy that was used in 2006 was updated to retrieve relevant studies. Inclusion of articles was determined using a predetermined protocol, independent assessment by 2 reviewers, and a final consensus decision. RESULTS: Seventeen randomized controlled trials and 3 nonrandomized comparative studies were included in this review. In most cases, simulation-based training was in addition to patient-based training programs. Only 2 studies directly compared simulation-based training in isolation with patient-based training. For laparoscopic cholecystectomy (n = 10 studies) and endoscopy (n = 10 studies), participants who reached simulation-based skills proficiency before undergoing patient-based assessment performed with higher global assessment scores and fewer errors in the operating room than their counterparts who did not receive simulation training. Not all parameters measured were improved. Two of the endoscopic studies compared simulation-based training in isolation with patient-based training with different results: for sigmoidoscopy, patient-based training was more effective, whereas for colonoscopy, simulation-based training was equally effective. CONCLUSIONS: Skills acquired by simulation-based training seem to be transferable to the operative setting for laparoscopic cholecystectomy and endoscopy. Future research will strengthen these conclusions by evaluating predetermined competency levels on the same simulators and using objective validated global rating scales to measure operative performance. 2013 by Lippincott Williams and Wilkins.
   Publication type: Journal: Review
   Source: EMBASE
   Full text: Available Ovid at Annals of Surgery

2. Title: Advanced airway management simulation training in medical education: A systematic review and meta-analysis
   Citation: Critical Care Medicine, January 2014, vol./is. 42/1(169-178), 0090-3493;1530-0293 (January 2014)
   Author(s): Kennedy C.C., Cannon E.K., Warner D.O., Cook D.A.
   Language: English
   Abstract: OBJECTIVE: To perform a systematic review and meta-analysis of the literature on teaching airway management using technology-enhanced simulation. DATA SOURCES: We searched MEDLINE, EMBASE, CINAHL, PsycINFO, ERIC, Web of Science, and Scopus for eligible articles through May 11, 2011. STUDY SELECTION: Observational or controlled trials instructing medical professionals in direct or fiberoptic intubation, surgical airway,
and/or supraglottic airway using technology-enhanced simulation were included. Two reviewers determined eligibility. DATA EXTRACTION:: Study quality, instructional design, and outcome data were abstracted independently and in duplicate. DATA SYNTHESIS:: Of 10,904 articles screened, 76 studies were included (n = 5,226 participants). We used random effects meta-analysis to pool results. In comparison with no intervention, simulation training was associated with improved outcomes for knowledge (standardized mean difference, 0.77 [95% CI, 0.19-1.35]; n = 7 studies) and skill (1.01 [0.68-1.34]; n = 28) but not for behavior (0.52 [-0.30 to 1.34]; n = 4) or patient outcomes (-0.12 [-0.41 to 0.16]; n = 4). In comparison with nonsimulation interventions, simulation training was associated with increased learner satisfaction (0.54 [0.37-0.71]; n = 2), improved skills (0.64 [0.12-1.16]; n = 5), and patient outcomes (0.86 [0.12-1.59]; n = 3) but not knowledge (0.29 [-0.28 to 0.86]; n = 4). We found few comparative effectiveness studies exploring how to optimize the use of simulation-based training, and these revealed inconsistent results. For example, animal models were found superior to manikins in one study (p = 0.004) using outcome of task speed but inferior in another study in terms of skill ratings (p = 0.02). Five studies comparing simulators of high versus low technical sophistication found no significant difference in skill outcomes (p > 0.31). Limitations of this review include heterogeneity (I > 50% for most analysis) and variation in quality among primary studies. CONCLUSIONS:: Simulation-based airway management curriculum is superior to no intervention and nonsimulation intervention for important education outcomes. Further research is required to fine-tune optimal curricular design. 2013 by the Society of Critical Care Medicine.

**Publication type:** Journal: Review  
**Source:** EMBASE  
**Full text:** Available *Critical care medicine* at Critical Care Medicine

### 3. Title: An update and review of simulation in urological training  
**Citation:** International Journal of Surgery, 2014, vol./is. 12/2(103-108), 1743-9191;1743-9159 (2014)  
**Author(s):** Brewin J., Ahmed K., Challacombe B.  
**Language:** English  
**Abstract:** Simulation, if appropriately integrated into surgical training, may provide a time efficient, cost effective and safe method of training. The use of simulation in urology training is supported by a growing evidence base for its use, leading many authors to call for it to be integrated into the curriculum. There is growing evidence for the utilisation of part task (technical skills) simulators to shorten the learning curve in an environment that does not compromise patient safety. There is also evidence that non-technical skills affect patient outcomes in the operating room and that high fidelity team based simulation training can improve non-technical skills and surgical team performance. This evidence has strengthened the argument of surgical educators who feel that simulation should be formally incorporated into the urology training curriculum to develop both technical and non-technical skills with the aim of optimising performance and patient safety. 2013 Surgical Associates Ltd.  
**Publication type:** Journal: Review  
**Source:** EMBASE

### 4. Title: Benefits of simulation based training for neonatal resuscitation education: A systematic review  
**Citation:** Resuscitation, October 2014, vol./is. 85/10(1320-1323), 0300-9572;1873-1570 (01 Oct 2014)  
**Author(s):** Rakshashbhuvankar A.A., Patole S.K.  
**Language:** English  
**Abstract:** Background: Simulation-based training (SBT) is being more frequently recommended for neonatal resuscitation education (NRE). It is important to assess if SBT improves clinical outcomes as neonatal resuscitation aims to improve survival without long-term neurodevelopmental impairment. We aimed to assess the evidence supporting benefits of SBT in NRE. Method: A systematic review was conducted using the Cochrane methodology. PubMed, Embase, PsycINFO and Cochrane databases were searched. Related abstracts were scanned and full texts of the potentially relevant articles were studied. Randomised controlled trials (RCT) and quasi-experimental studies with controls (non-RCT) assessing SBT for NRE were eligible for inclusion in the review. Results: Four small studies [three RCT (n = 126) and one non-RCT (n = 60)] evaluated SBT for NRE. Participants included medical students (one RCT and one non-RCT), residents (one RCT) and nursing staff (one RCT). Outcomes included performance in a simulation scenario, theoretical knowledge, and confidence in leading a resuscitation scenario. One RCT favoured simulation [improved resuscitation score (. p=. 0.016), 2.31 more number of critical actions (. p= 0.017) and decreased time to achieve resuscitation steps (. p= .0001)]. The remaining two RCTs and the non-RCT did not find any difference between SBT and alternate methods of instruction. None of the four studies reported clinical outcomes. Conclusions: Evidence regarding benefits of SBT for NRE is limited. There are no data on clinical outcomes following SBT for NRE. Large RCTs assessing clinically important outcomes are required before SBT can be recommended widely for NRE.
5. Title: Central venous access by trainees: a systematic review and meta-analysis of the use of simulation to improve success rate on patients

Citation: Simulation in healthcare : journal of the Society for Simulation in Healthcare, February 2014, vol./is. 9/1(7-14), 1559-713X (Feb 2014)

Author(s): Madenci A.L., Solis C.V., de Moya M.A.

Language: English

Abstract: Simulation training for invasive procedures may improve patient safety by enabling efficient training. This study is a meta-analysis with rigorous inclusion and exclusion criteria designed to assess the real patient procedural success of simulation training for central venous access. Published randomized controlled trials and prospective 2-group cohort studies that used simulation for the training of procedures involving central venous access were identified. The quality of each study was assessed. The primary outcome was the proportion of trainees who demonstrated the ability to successfully complete the procedure. Secondary outcomes included the mean number of attempts to procedural success and periprocedural adverse events. Proportions were compared between groups using risk ratios (RRs), whereas continuous variables were compared using weighted mean differences. Random-effects analysis was used to determine pooled effect sizes. We identified 550 studies, of which 5 (3 randomized controlled trials, 2 prospective 2-group cohort studies) studies of central venous catheter (CVC) insertion were included in the meta-analysis, composed of 407 medical trainees. The simulation group had a significantly larger proportion of trainees who successfully placed CVCs (RR, 1.09; 95% confidence interval [CI], 1.03-1.16, P<0.01). In addition, the simulation group had significantly fewer mean attempts to CVC insertion (weighted mean difference, -1.42; 95% CI, -2.34 to -0.49, P<0.01). There was no significant difference in the rate of adverse events between the groups (RR, 0.50; 95% CI, 0.19-1.29; P=0.15). Training programs should consider adopting simulation training for CVC insertion to improve the real patient procedural success of trainees.

Publication type: Journal: Review

Source: EMBASE

6. Title: Do high-fidelity training models translate into better skill acquisition for an endourologist?.

Citation: Current Opinion in Urology, March 2015, vol./is. 25/2(143-52), 0963-0643;1473-6586 (2015 Mar)

Author(s): Cloutier J, Traxer O

Language: English

Abstract: PURPOSE OF REVIEW: Nowadays, accessibility to the operative room is becoming more limited for medical students and residents, principally due to decreasing operative time, increasing waiting list, ethical consideration and legal issue in case of any complications. Simulation models have gained in popularity and are now considered a major component in the training and skill development of medical students and residents before coming to the operative room. In this review, we summarized and discussed the relevant aspect of ureteroscopy training models and gave an overview of the advantage in skill acquisition while training with a high-fidelity model.RECENT FINDINGS: Currently, there is an increase in surgical programs trying to implement endourology training models into the curriculum. The training simulators that would allow the medical students and residents to rapidly reach an autonomous level are yet to be developed. Several ureteroscopy models have been described and validated; however, the transposition of skill acquisition into real-life surgery is not properly demonstrated.SUMMARY: Training reduces the learning curve for novice medical students or residents. However, further studies are still needed to better define the impact of skill acquisition in real life and its sustainability.

Publication type: Journal Article

Source: MEDLINE


Citation: BMJ Open, 2015, vol./is. 5/1(e005472), 2044-6055 (2015)

Author(s): Watters C, Reedy G, Ross A, Morgan NJ, Handslip R, Jaye P

Language: English

Abstract: OBJECTIVES: In this work, we have compared uniprofessional and interprofessional versions of a simulation education intervention, in an attempt to understand more about whether it improves trainees’ self-efficacy. BACKGROUND: Interprofessionalism has been climbing the healthcare agenda for over 50 years. Simulation education attempts to create an environment for healthcare professionals to learn, without potential safety risks for patients. Integrating simulation and interprofessional education can provide benefits to individual learners.SETTING: The intervention took place in a high-fidelity simulation facility located on the campus of a large urban hospital. The
Abstract: Based trauma team training of non-critical incidents. Simulation and inconclusive evidence regarding feedback and simulation modalities. Conclusions: Simulation training significantly improved endoscopic process skills in a test setting (ES, 0.79; n= 22), process behaviors in clinical practice (ES, 0.49; n= 8), time to procedure completion in both a test setting (ES, 0.79; n= 16) and clinical practice (ES, 0.75; n= 5), and patient outcomes (procedure completion and risk of major complications; ES, 0.45; n= 10). Only 5 studies evaluated the comparative effectiveness of different SBT approaches; which provided inconclusive evidence regarding feedback and simulation modalities. Conclusions: Simulation-based education in gastrointestinal endoscopy is associated with improved performance in a test setting and in clinical practice, and improved patient outcomes compared with no intervention. Comparative effectiveness studies of different simulation modalities are limited.

Publication type: Journal: Review
Source: EMBASE

9. Title: Efficacy of simulation-based trauma team training of non-technical skills. A systematic review
Citation: Acta Anaesthesiologica Scandinavica, August 2014, vol./is. 58/7(775-787), 0001-5172;1399-6576 (August 2014)
Author(s): Gjeraa K., MOller T.P., Ostergaard D.
Language: English
Abstract: Trauma resuscitation is a complex situation, and most organisations have multi-professional trauma teams. Non-technical skills are challenged during trauma resuscitation, and they play an important role in the prevention of critical incidents. Simulation-based training of these is recommended. Our research question was: Does simulation-based trauma team training of non-technical skills have effect on reaction, learning, behaviour or patient outcome? The authors searched PubMed, EMBASE and the Cochrane Library and found 13 studies eligible for analysis. We described and compared the educational interventions and the evaluations of effect according to the four Kirkpatrick levels: reaction, learning (knowledge, skills, attitudes), behaviour (in a clinical setting) and patient outcome. No
studies were randomised, controlled and blinded, resulting in a moderate to high risk of bias. The multi-professional trauma teams had positive reactions to simulation-based training of non-technical skills. Knowledge and skills improved in all studies evaluating the effect on learning. Three studies found improvements in team performance (behaviour) in the clinical setting. One of these found difficulties in maintaining these skills. Two studies evaluated on patient outcome, of which none showed improvements in mortality, complication rate or duration of hospitalisation. A significant effect on learning was found after simulation-based training of the multi-professional trauma team in non-technical skills. Three studies demonstrated significantly increased clinical team performance. No effect on patient outcome was found. All studies had a moderate to high risk of bias. More comprehensive randomised studies are needed to evaluate the effect on patient outcome.

**Purpose:** To evaluate the feasibility and educational value of high-fidelity, interprofessional team-based simulation in radiation oncology. Methods: The simulation event was conducted in a radiation oncology department during a non-clinical day. It involved 5 simulation scenarios that were run over three 105 minute timeslots in a single day. High-acuity, low-frequency clinical situations were selected and included HDR brachytherapy emergency, 4D CT artifact management, pediatric emergency clinical mark-up, electron scalp trial set-up and a cone beam CT misregistration incident. A purposive sample of a minimum of 20 trainees was required to assess recruitment feasibility. A faculty radiation oncologist (RO), medical physicist (MP) or radiation therapist (RTT), facilitated each case. Participants completed a pre-event survey of demographic data and motivation for participation. A post event survey collected perceptions of familiarity with the clinical content, comfort with interprofessional practice, and event satisfaction, scored on a 1-10 scale in terms of clinical knowledge, clinical decision making, clinical skills, exposure to other trainees and interprofessional communication. Means and standard deviations were calculated. Results: Twenty-one trainees participated including 6 ROs (29%), 6 MPs (29%), and 9 RTTs (43%). All 12 cases (100%) were completed within the allocated 105 minutes. Nine faculty facilitators, (3MP, 2 RO, 4 RTTs) were required for 405 minutes each. Additional costs associated with this event were 154 hours to build the high-fidelity scenarios, 2 standardized patients (SPs) for a total of 15.5 hours, and consumables. The mean (+/SD) educational value score reported by participants with respect to clinical knowledge was 8.9 (1.1), clinical decision making 8.9 (1.3), clinical
skills 8.9 (1.1), exposure to other trainees 9.1 (2.3) and interprofessional communication 9.1 (1.0). Fifteen (71%) participants reported the cases were of an appropriate complexity. The importance of further simulation events was rated highly at 9.1/10. Conclusions: High-fidelity simulation training is feasible and effective in a radiation oncology context. However, such educational activities require significant resources, including personnel and equipment.

**Publication type:** Journal: Article  
**Source:** EMBASE  
**Full text:** Available ProQuest at Radiation Oncology

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**12. Title:** Expertise in medicine: using the expert performance approach to improve simulation training  
**Citation:** Medical education, February 2014, vol./is. 48/2(115-123), 1365-2923 (Feb 2014)  
**Author(s):** Causer J., Barach P., Williams A.M.  
**Language:** English  
**Abstract:** We critically review how medical education can benefit from systematic use of the expert performance approach as a framework for measuring and enhancing clinical practice. We discuss how the expert performance approach can be used to better understand the mechanisms underpinning superior performance among health care providers and how the framework can be applied to create simulated learning environments that present increased opportunities to engage in deliberate practice. The expert performance approach is a systematic, evidence-based framework for measuring and analysing superior performance. It has been applied in a variety of domains, but has so far been relatively neglected in medicine and health care. Here we outline the framework and demonstrate how it can be effectively applied to medical education. Deliberate practice is defined as a structured and reflective activity, which is designed to develop a critical aspect of performance. Deliberate practice provides an opportunity for error detection and correction, repetition, access to feedback and requires maximal effort, complete concentration and full attention. We provide guidance on how to structure simulated learning environments to encourage the accumulation of deliberate practice. We highlight the role of simulation-based training in conjunction with deliberate practice activities such as reflection, rehearsal, trial-and-error learning and feedback in improving the quality of patient care. We argue that the development of expertise in health care is directly related to the systematic identification and improvement of quantifiable performance metrics. In order to optimise the training of expert health care providers, advances in simulation technology need to be coupled with effective instructional systems design, with the latter being strongly guided by empirical research from the learning and cognitive sciences. 2014 John Wiley & Sons Ltd.  
**Publication type:** Journal: Review  
**Source:** EMBASE

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**13. Title:** High-stakes assessment of the non-technical skills of critical care trainees using simulation: feasibility, acceptability and reliability  
**Citation:** Critical care and resuscitation : journal of the Australasian Academy of Critical Care Medicine, March 2014, vol./is. 16/1(6-12), 1441-2772 (Mar 2014)  
**Author(s):** Nunnink L., Foot C., Venkatesh B., Corke C., Saxena M., Lucey M., Jones M.  
**Language:** English  
**Abstract:** To evaluate the use of high-fidelity simulation for summative high-stakes assessment of intensive care trainees, focusing on non-technical skills (NTS), testing feasibility and acceptability of simulation assessment, and the reliability of two NTS rating scales. Prospective observational study of senior intensive care trainees in a simulated specialist examination. Participants undertook a simulated patient management scenario and were assessed using two rating scales: the Anaesthesia Non-technical Skills (ANTS) scale and the Ottawa Global Rating Scale (GRS). Assessors were trained, currently active, high-stakes examiners. Participants also completed a survey on simulation-based summative assessment. The inter-rater reliability of two rating scales for NTS assessment. We evaluated the feasibility of simulation-based assessment, and used survey results to assess acceptability to participants. Simulation assessment was feasible. Participants considered simulation-based high-stakes assessment to be acceptable and felt their scenario performance was reflective of real-world performance. Participants identified a need for debriefing following scenario-based assessment. Inter-rater reliability was fair for the ANTS and Ottawa GRS scores (intra-class correlation coefficient, 0.39 and 0.42, respectively). There was only fair agreement between raters for an NTS pass or fail (weighted kappa, 0.32) and for a technical skills pass or fail (weighted kappa, 0.36). Summative high-stakes assessment using a single simulated scenario was feasible and acceptable to senior intensive care trainees. The low inter-rater reliability for the ANTS and Ottawa GRS rating scales and for pass or fail discrimination may limit its incorporation into an existing examination format.  
**Publication type:** Journal: Article
14. Title: In situ simulation training for neonatal resuscitation: an RCT
Citation: Pediatrics, September 2014, vol./is. 134/3(e790-797), 1098-4275 (Sep 2014)
Author(s): Rubio-Gurung S., Putet G., Touzet S., Gauthier-Molinier H., Jordan I., Beissel A., Labaune J.M., Blanc S., Amamra N., Balandras C., Rudigoz R.C., Colin C., Picaud J.C.
Language: English
Abstract: High-fidelity simulation is an effective tool in teaching neonatal resuscitation skills to professionals. We aimed to determine whether in situ simulation training (for ~80% of the delivery room staff) improved neonatal resuscitation performed by the staff at maternities. A baseline evaluation of 12 maternities was performed: a random sample of 10 professionals in each unit was presented with 2 standardized scenarios played on a neonatal high-fidelity simulator. The medical procedures were video recorded for later assessments. The 12 maternities were then randomly assigned to receive the intervention (a 4-hour simulation training session delivered in situ for multidisciplinary groups of 6 professionals) or not receive it. All maternities were evaluated again at 3 months after the intervention. The videos were assessed by 2 neonatologists blinded to the pre-/postintervention as well as to the intervention/control groups. The performance was assessed using a technical score and a team score. After intervention, the median technical score was significantly higher for scenarios 1 and 2 for the intervention group compared with the control group (P = .01 and 0.004, respectively), the median team score was significantly higher (P < .001) for both scenarios. In the intervention group, the frequency of achieving a heart rate >90 per minute at 3 minutes improved significantly (P = .003), and the number of hazardous events decreased significantly (P < .001). In situ simulation training with multidisciplinary teams can effectively improve technical skills and teamwork in neonatal resuscitation. Copyright 2014 by the American Academy of Pediatrics.
Publication type: Journal: Article
Source: EMBASE
Full text: Available EBSCOhost EJS at Pediatrics

15. Title: Reconsidering fidelity in simulation-based training
Citation: Academic Medicine, March 2014, vol./is. 89/3(387-392), 1040-2446;1938-808X (March 2014)
Author(s): Hamstra S.J., Brydges R., Hatala R., Zendejas B., Cook D.A.
Language: English
Abstract: In simulation-based health professions education, the concept of simulator fidelity is usually understood as the degree to which a simulator looks, feels, and acts like a human patient. Although this can be a useful guide in designing simulators, this definition emphasizes technological advances and physical resemblance over principles of educational effectiveness. In fact, several empirical studies have shown that the degree of fidelity appears to be independent of educational effectiveness. The authors confronted these issues while conducting a recent systematic review of simulation-based health professions education, and in this Perspective they use their experience in conducting that review to examine key concepts and assumptions surrounding the topic of fidelity in simulation. Several concepts typically associated with fidelity are more useful in explaining educational effectiveness, such as transfer of learning, learner engagement, and suspension of disbelief. Given that these concepts more directly influenceproperties of the learning experience, the authors make the following recommendations: (1) abandon the term fidelity in simulation-based health professions education and replace it with terms reflecting the underlying primary concepts of physical resemblance and functional task alignment; (2) make a shift away from the current emphasis on physical resemblance to a focus on functional correspondence between the simulator and the applied context; and (3) focus on methods to enhance educational effectiveness using principles of transfer of learning, learner engagement, and suspension of disbelief. These recommendations clarify underlying concepts for researchers in simulation-based health professions education and will help advance this burgeoning field.
Publication type: Journal: Article
Source: EMBASE
Full text: Available Ovid at Academic Medicine

16. Title: Simulation-based neonatal and infant resuscitation teaching: A systematic review of randomized controlled trials
Citation: Klinische Padiatrie, September 2014, vol./is. 226/5(259-267), 0300-8630;1439-3824 (September 2014)
Author(s): Mileder L.P., Urlesberger B., Szylj E.G., Roehr C.C., Schmolzer G.M.
Language: English
Abstract: Background: Current resuscitation guidelines recommend the use of simulation-based medical education (SBME) as an instructional methodology to improve patient safety and health. We sought to investigate the...
evidence-base for the effectiveness of SBME for neonatal and pediatric resuscitation training. Method: Therefore, we conducted a systematic literature research of electronic databases (PubMed, EMBASE, Clinical Trials). Results: 13 randomized controlled trials with a total of 832 participants were identified. However, due to distinct differences in research objectives and varying outcome assessment a meta-analysis of studies could not be conducted. Eligible trials showed that SBME can enhance trainees' cognitive, technical, and behavioral skills as well as self-confidence. Discussion/Conclusion: Skills acquired in the simulated environment can be integrated in clinical practice, and SBME might also lead to improved patient safety and health. Further research on SBME - especially investigating patient outcomes - is urgently required in order to strengthen these results and to establish a sound evidence-base for the effectiveness of SBME for neonatal and infant resuscitation training. Georg Thieme Verlag KG Stuttgart New York.

Publication type: Journal: Review
Source: EMBASE

17. Title: Simulation-based training in anaesthesiology: A systematic review and meta-analysis
Citation: British Journal of Anaesthesia, February 2014, vol./is. 112/2(231-245), 0007-0912;1471-6771 (February 2014)
Author(s): Lorello G.R., Cook D.A., Johnson R.L., Brydges R.
Language: English
Abstract: Simulation has long been integrated in anaesthesiology training, yet a comprehensive review of its effectiveness is presently lacking. Using meta-analysis and critical narrative analysis, we synthesized the evidence for the effectiveness of simulation-based anaesthesiology training. We searched MEDLINE, ERIC, and SCOPUS through May 2011 and included studies using simulation to train health professional learners. Data were abstracted independently and in duplicate. We included 77 studies (6066 participants). Compared with no intervention (52 studies), simulation was associated with moderate to large pooled effect sizes (ESS) for all outcomes (ES range 0.60-1.05) except for patient effects (ES -0.39). Compared with non-simulation instruction (11 studies), simulation was associated with moderate effects for satisfaction and skills (ES 0.39 and 0.42, respectively), large effect for behaviours (1.77), and small effects for time, knowledge, and patient effects (-0.18 to 0.23). In 17 studies comparing alternative simulation interventions, training in non-technical skills (e.g. communication) and medical management compared with training in medical management alone was associated with negligible effects for knowledge and skills (four studies, ES range 0.14-0.15). Debriefing using multiple vs single information sources was associated with negligible effects for time and skills (three studies, ES range -0.07 to 0.09). Our critical analysis showed inconsistency in measurement of non-technical skills and consistency in the (ineffective) design of debriefing. Simulation in anaesthesiology appears to be more effective than no intervention (except for patient outcomes) and non-inferior to non-simulation instruction. Few studies have clarified the key instructional designs for simulation-based anaesthesiology training. 2013 The Author [2013]. Published by Oxford University Press on behalf of the British Journal of Anaesthesia. All rights reserved. For Permissions, please email: journals.permissions@oup.com.
Publication type: Journal: Review
Source: EMBASE

18. Title: Simulation-based ureteroscopy training: A systematic review
Citation: Journal of Surgical Education, January 2014, vol./is. 72/1(135-143), 1931-7204;1878-7452 (01 Jan 2015)
Language: English
Abstract: Objective Simulation is a common adjunct to operative training and various modalities exist for ureteroscopy. This systematic review aims the following: (1) to identify available ureteroscopy simulators, (2) to explore evidence for their effectiveness using characteristic criterion, and (3) to provide recommendations for simulation-based ureteroscopy training. Design The preferred reporting items for systematic reviews and meta-analysis statement guidelines were used. A literature search was performed using the PubMed, EMBASE, and Cochrane Library databases. Results In total, 20 articles concerning ureteroscopy simulators were included. Overall, 3 high-fidelity bench models are available. The Uro-Scopic Trainer has demonstrated face, construct, and concurrent validity, whereas the Scope Trainer has undergone content, construct, and predictive validation. The adult ureteroscopy trainer has demonstrated face, content, and construct validity. The URO Mentor is the only available ureteroscopy virtual-reality system; 10 studies were identified demonstrating its face, content, construct, concurrent, and predictive validity. The Uro-Scopic Trainer, the Scope Trainer, and the URO Mentor have demonstrated high educational impact. A noncommercially available, low-fidelity model has demonstrated effectiveness comparable to its high-fidelity counterpart at 185 times lesser than the price of the Uro-Scopic Trainer. The use of porcine models has also been described in 3 studies but require further study. Conclusions Valid models are available for simulation-based ureteroscopy training. However, there is a lack of many high-level studies.
conducted, and further investigation is required in this area. Furthermore, current research focuses on the technical skills acquisition with little research conducted on nontechnical skills acquisition within ureteroscopy. The next step for ureteroscopy training is a formalized and validated curriculum, incorporating simulation, training models, development of nontechnical skills, and real-life practice.

**Publication type:** Journal: Article  
**Source:** EMBASE

19. **Title:** Systematic review of skills transfer after surgical simulation-based training  
**Citation:** British Journal of Surgery, August 2014, vol./is. 101/9(1063-1076), 0007-1323;1365-2168 (August 2014)  
**Language:** English  
**Abstract:** Background Simulation-based training assumes that skills are directly transferable to the patient-based setting, but few studies have correlated simulated performance with surgical performance. Methods A systematic search strategy was undertaken to find studies published since the last systematic review, published in 2007. Inclusion of articles was determined using a predetermined protocol, independent assessment by two reviewers and a final consensus decision. Studies that reported on the use of surgical simulation-based training and assessed the transferability of the acquired skills to a patient-based setting were included. Results Twenty-seven randomized clinical trials and seven non-randomized comparative studies were included. Fourteen studies investigated laparoscopic procedures, 13 endoscopic procedures and seven other procedures. These studies provided strong evidence that participants who reached proficiency in simulation-based training performed better in the patient-based setting than their counterparts who did not have simulation-based training. Simulation-based training was equally as effective as patient-based training for colonoscopy, laparoscopic camera navigation and endoscopic sinus surgery in the patient-based setting. Conclusion These studies strengthen the evidence that simulation-based training, as part of a structured programme and incorporating predetermined proficiency levels, results in skills transfer to the operative setting. Simulation-based training needs wider adoption  2014 BJS Society Ltd. Published by John Wiley & Sons Ltd.  
**Publication type:** Journal: Review  
**Source:** EMBASE

20. **Title:** The effect of high-fidelity simulation on the confidence and decision-making ability of anaesthesia trainees in managing subsequent simulated 'Can't Intubate, Can't Oxygenate' scenarios  
**Citation:** Anaesthesia and Intensive Care, March 2014, vol./is. 42/2(207-212), 0310-057X;1448-0271 (March 2014)  
**Author(s):** McCrossin K.E., White H.T., Sane S.  
**Language:** English  
**Abstract:** The decision to attempt a percutaneous airway in a recognised 'Can't Intubate, Can't Oxygenate' (CICO) situation may occur too late to avoid a poor outcome. Our study was designed to investigate the effect of high-fidelity simulation on the confidence and decision-making ability of anaesthesia trainees in managing CICO scenarios in subsequent simulation. Nine anaesthesia trainees from Logan Hospital participated. Pre-study questionnaires surveying confidence levels in various anaesthetic crises were completed. All participants underwent an education session based on algorithms developed for failed intubation and ventilation, and techniques for securing percutaneous airway access. However, only four of the nine participated in a high-fidelity simulation session. All nine participants were then filmed during ‘mini-simulation’ assessment sessions and completed post-study questionnaires identical to those at the commencement of the study. The four trainees who had undertaken the initial high-fidelity simulation had a lower median time to laryngeal mask airway attempt (60 versus 115 seconds) and time to percutaneous airway attempt (111 versus 172 seconds) in the subsequent simulation. The median number of deviations from the Difficult Airway Society algorithm was 0 for the simulation group compared to 1 for the non-simulation group. This small study suggests that high-fidelity simulation shortens the decision-making time of anaesthesia trainees in subsequent simulated CICO scenarios. This observation warrants follow-up in larger prospective trials.  
**Publication type:** Journal: Article  
**Source:** EMBASE

21. **Title:** The relationship of praise/criticism to learning during obstetrical simulation: A randomized clinical trial  
**Citation:** Journal of Perinatal Medicine, July 2014, vol./is. 42/4(479-486), 0300-5577;1619-3997 (July 2014)  
**Author(s):** Saraf S., Bayya J., Weedon J., Minkoff H., Fisher N.  
**Language:** English  
**Abstract:** Aims: The effect of positive vs. negative comments (praise vs. criticism) on trainees' subsequent cognitive
and technical performance is unknown, but of potential importance. We performed a randomized trial of giving either praise or criticism during simulated normal vaginal deliveries (using a high-fidelity birthing simulator) to assess the differential effect of these types of comments on students' cognitive and technical performance, and perceived confidence after their learning experience. Methods: Medical and nursing students underwent stratified randomization to praise or criticism. Students (n = 59) initially participated in a teaching demonstration and practiced normal spontaneous vaginal delivery using a birthing simulator. A baseline assessment of cognitive and technical skills, and of self-confidence, was followed by a second simulation during which positive or negative comments were given using standardized scripts. Cognitive performance, technical performance and confidence measures were then scored again. Results: Cognitive and technical performance scores in the "praise" group improved significantly by 2.5 (P = 0.007) and 1.8 (P = 0.032), respectively, while those in the "criticism" group remained unchanged. The self-reported confidence scores did not show any significant change from baseline in either group. Conclusions: Praise strengthens students' cognitive and technical performances, while criticism does not.

Publication type: Journal: Article
Source: EMBASE

22. Title: The use of simulation in neurosurgical education and training: A systematic review
Citation: Journal of Neurosurgery, August 2014, vol./is. 121/2(228-246), 0022-3085;1933-0693 (August 2014)
Language: English
Abstract: Object. There is increasing evidence that simulation provides high-quality, time-effective training in an era of resident duty-hour restrictions. Simulation may also permit trainees to acquire key skills in a safe environment, important in a specialty such as neurosurgery, where technical error can result in devastating consequences. The authors systematically reviewed the application of simulation within neurosurgical training and explored the state of the art in simulation within this specialty. To their knowledge this is the first systematic review published on this topic to date. Methods. The authors searched the Ovid MEDLINE, Embase, and PsycINFO databases and identified 4101 articles; 195 abstracts were screened by 2 authors for inclusion. The authors reviewed data on study population, study design and setting, outcome measures, key findings, and limitations. Results. Twenty-eight articles formed the basis of this systematic review. Several different simulators are at the neurosurgeon's disposal, including those for ventriculostomy, neuroendoscopic procedures, and spinal surgery, with evidence for improved performance in a range of procedures. Feedback from participants has generally been favorable. However, study quality was found to be poor overall, with many studies hampered by nonrandomized design, presenting normal rather than abnormal anatomy, lack of control groups and long-term follow-up, poor study reporting, lack of evidence of improved simulator performance translating into clinical benefit, and poor reliability and validity evidence. The mean Medical Education Research Study Quality Instrument score of included studies was 9.21 +/- 1.95 (+/- SD) out of a possible score of 18. Conclusions. The authors demonstrate qualitative and quantitative benefits of a range of neurosurgical simulators but find significant shortfalls in methodology and design. Future studies should seek to improve study design and reporting, and provide long-term follow-up data on simulated and ideally patient outcomes. AANS, 2014.
Publication type: Journal: Review
Source: EMBASE

23. Title: The use of simulation in the acquisition of laparoscopic suturing skills
Citation: International Journal of Surgery, 2014, vol./is. 12/4(258-268), 1743-9191;1743-9159 (2014)
Author(s): Dehabadi M., Fernando B., Berlingieri P.
Language: English
Abstract: Objective: Laparoscopic suturing is recognised as one of the most difficult laparoscopic skills to master. With the use of simulation increasing in the training of future surgeons, a comprehensive literature review was carried out to evaluate the current evidence for the role of simulators in facilitating the acquisition of this particular skill. Method: A PubMed search was performed using terms 'laparoscopy', 'suturing', and 'simulation'. The resulting literature was then analysed for relevance and summarised. Results: A total of 68 relevant articles were found and evaluated; despite the relatively small sample size in most studies, simulation has been proven to provide an effective method for the tuition of surgical trainees in laparoscopic suturing. Furthermore, the skills acquired through simulator training appear to be successfully transferable to the operating room environment. Simulators have also shown potential as valuable tools in the assessment of proficiency in trainees, with their evaluation of individuals correlating well with expert observer ratings in complex laparoscopic tasks such as suturing. Questions regarding the type of simulator to be used, the nature of the training curriculum, and how such a curriculum can practically be integrated into current surgical training programmes remain to be answered. Conclusions: Simulation is an integral
tool in the training of future laparoscopic surgeons, and further research is required to answer the question of how to maximise benefit from these invaluable training implements. 2014 Surgical Associates Ltd.

**Publication type:** Journal: Review  
**Source:** EMBASE

**24. Title:** Towards the next frontier for simulation-based training: Full-hospital simulation across the entire patient pathway  
**Citation:** Annals of Surgery, August 2014, vol./is. 260/2(252-258), 0003-4932;1528-1140 (August 2014)  
**Author(s):** Arora S., Cox C., Davies S., Kassab E., Mahoney P., Sharma E., Darzi A., Vincent C., Sevdalis N.  
**Language:** English  
**Abstract:** Objective: To evaluate the efficacy of an entire hospital simulation in imparting skills to expert healthcare providers, encompassing both retention and transfer to clinical practice. Background: Studies demonstrating the effectiveness of simulation do not concentrate upon expert multidisciplinary teams. Moreover, their focus is confined to a single clinical setting, thereby not considering the complex interactions across multiple hospital departments. Methods: A total of 288 participants (Attending surgeons, anesthesiologists, physicians, and nurses) completed this largest simulation study to date, set in the UK Defence Medical Services' Hospital Simulator and the conflict zone in Afghanistan. The simulator termed "Hospital Exercise" (HOSPEX) is a fully immersive live-in simulation experience that covers the entire environment of a military hospital with all departments. Participants undertook a 3-day training program within HOSPEX before deployment to war zones. Primary outcome measures were assessed with IMPAcT (the Imperial Military Personnel Assessment Tool). IMPAcT measures crisis management, trauma care, hospital environment, operational readiness, and transfer of skills to civilian practice. Reliability, skills learning, and retention in the conflict zone were assessed statistically. Results: Reliability in skills assessment was excellent (Cronbach alpha: nontechnical skills = 0.87-0.94; environment/patient skills = 0.83-0.95). Pre/post-HOSPEX comparisons revealed significant improvements in decision making (M = 4.98, SD = 1.20 to M = 5.39, SD = 0.91; P = 0.03), situational awareness (M = 5.44, SD = 1.04 to M = 5.74, SD = 0.92; P = 0.01), trauma care (M = 5.53, SD = 1.23 to M = 5.85, SD = 1.09; P = 0.05), and knowledge of hospital environment (M = 5.19, SD = 1.17 to M = 5.42, SD = 0.97; P = 0.04). No skills decayed over time when assessed several months later in the real conflict zone. All skills transferred to civilian clinical practice. Conclusions: This is the first study to describe the value of a full-hospital simulation across the entire patient pathway. Such macrosimulations may be the way forward for integrating the complex training needs of expert clinicians and testing organizational "fitness for purpose" of entire hospitals. Copyright 2014 Lippincott Williams & Wilkins.

**Publication type:** Journal: Article  
**Source:** EMBASE  
**Full text:** Available Ovid at Annals of Surgery

**25. Title:** Training situational awareness to reduce surgical errors in the operating room.  
**Citation:** British Journal of Surgery, January 2015, vol./is. 102/1(16-23), 0007-1323;1365-2168 (2015 Jan)  
**Author(s):** Graafland M, Schraagen JM, Boermeester MA, Bemelman WA, Schijven MP  
**Language:** English  
**Abstract:** BACKGROUND: Surgical errors result from faulty decision-making, misperceptions and the application of suboptimal problem-solving strategies, just as often as they result from technical failure. To date, surgical training curricula have focused mainly on the acquisition of technical skills. The aim of this review was to assess the validity of methods for improving situational awareness in the surgical theatre. METHODS: A search was conducted in PubMed, Embase, the Cochrane Library and PsycINFO using predefined inclusion criteria, up to June 2014. All study types were considered eligible. The primary endpoint was validity for improving situational awareness in the surgical theatre at individual or team level. RESULTS: Nine articles were considered eligible. These evaluated surgical team crisis training in simulated environments for minimally invasive surgery (4) and open surgery (3), and training courses focused at training non-technical skills (2). Two studies showed that simulation-based surgical team crisis training has construct validity for assessing situational awareness in surgical trainees in minimally invasive surgery. None of the studies showed effectiveness of surgical crisis training on situational awareness in open surgery, whereas one showed face validity of a 2-day non-technical skills training course. CONCLUSION: To improve safety in the operating theatre, more attention to situational awareness is needed in surgical training. Few structured curricula have been developed and validation research remains limited. Strategies to improve situational awareness can be adopted from other industries. Copyright 2014 BJS Society Ltd. Published by John Wiley & Sons Ltd.

**Publication type:** Journal Article, Research Support, Non-U.S. Gov't, Review  
**Source:** MEDLINE
26. Title: Transfer of learning and patient outcome in simulated crisis resource management: A systematic review

Citation: Canadian Journal of Anesthesia, June 2014, vol./is. 61/6(571-582), 0832-610X;1496-8975 (June 2014)

Author(s): Boet S, Bould M.D., Fung L., Qosa H., Perrier L., Tavares W., Reeves S., Tricco A.C.

Language: English

Abstract: Purpose: Simulation-based learning is increasingly used by healthcare professionals as a safe method to learn and practice non-technical skills, such as communication and leadership, required for effective crisis resource management (CRM). This systematic review was conducted to gain a better understanding of the impact of simulation-based CRM teaching on transfer of learning to the workplace and subsequent changes in patient outcomes. Source: Studies on CRM, crisis management, crew resource management, teamwork, and simulation published up to September 2012 were searched in MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials, and ERIC. All studies that used simulation-based CRM teaching with outcomes measured at Kirkpatrick Level 3 (transfer of learning to the workplace) or 4 (patient outcome) were included. Studies measuring only learners’ reactions or simple learning (Kirkpatrick Level 1 or 2, respectively) were excluded. Two authors independently reviewed all identified titles and abstracts for eligibility. Principal findings: Nine articles were identified as meeting the inclusion criteria. Four studies measured transfer of simulation-based CRM learning into the clinical setting (Kirkpatrick Level 3). In three of these studies, simulation-enhanced CRM training was found significantly more effective than no intervention or didactic teaching. Five studies measured patient outcomes (Kirkpatrick Level 4). Only one of these studies found that simulation-based CRM training made a clearly significant impact on patient mortality. Conclusions: Based on a small number of studies, this systematic review found that CRM skills learned at the simulation centre are transferred to clinical settings, and the acquired CRM skills may translate to improved patient outcomes, including a decrease in mortality. 2014 The Author(s).

Publication type: Journal: Review

Source: EMBASE

Full text: Available Canadian journal of anaesthesia = Journal canadien d’anesthésie at Canadian Journal of Anesthesia/Journal canadien d’anesthésie

27. Title: Twelve tips for a successful interprofessional team-based high-fidelity simulation education session.

Citation: Medical Teacher, October 2014, vol./is. 36/10(853-7), 0142-159X;1466-187X (2014 Oct)

Author(s): Boet S, Bould MD, Layat Burn C, Reeves S

Language: English

Abstract: Simulation-based education allows experiential learning without risk to patients. Interprofessional education aims to provide opportunities to different professions for learning how to work effectively together. Interprofessional simulation-based education presents many challenges, including the logistics of setting up the session and providing effective feedback to participants with different backgrounds and mental models. This paper aims to provide educators with a series of practical and pedagogical tips for designing, implementing, assessing, and evaluating a successful interprofessional team-based simulation session. The paper is organized in the sequence that an educator might use in developing an interprofessional simulation-based education session. Collectively, this paper provides guidance from determining interprofessional learning objectives and curricular design to program evaluation. With a better understanding of the concepts and pedagogical methods underlying interprofessional education and simulation, educators will be able to create conditions for a unique educational experience where individuals learn with and from other specialties and professions in a controlled, safe environment.

Publication type: Journal Article

Source: MEDLINE

28. Title: Use of human patient simulation and validation of the team situation awareness global assessment technique (TSAGAT): A multidisciplinary team assessment tool in trauma education

Citation: Journal of Surgical Education, January 2014, vol./is. 72/1(156-163), 1931-7204;1878-7452 (01 Jan 2015)

Author(s): Crozier M.S., Ting H.Y., Boone D.C., O’Regan N.B., Bandrauk N., Furey A., Squires C., Hapgood J., Hogan M.P.

Language: English

Abstract: Objective Situation awareness (SA) is a vital construct for decision making in intense, dynamic environments such as trauma resuscitation. Human patient simulation (HPS) allows for a safe environment where individuals can develop these skills. Trauma resuscitation is performed by multidisciplinary teams that are traditionally difficult to globally assess. Our objective was to create and validate a novel tool to measure SA in multidisciplinary trauma teams using a HPS - the Team Situation Awareness Global Assessment Technique (TSAGAT). Setting Memorial University Simulation Centre. Design/Participants Using HPS, 4 trauma teams completed 2 separate trauma scenarios. Student, junior resident, senior resident, and attending staff teams each had 3 members (trauma
Individual SAGATs were developed by experts in each respective field and contained shared and complimentary knowledge questions. Teams were assessed with SAGAT in real time and with traditional checklists using video review. TSAGAT was calculated as the sum of individual SAGAT scores and was compared with the traditional checklist scores. Results Shared, complimentary, and TSAGAT scores improved with increasing team experience. Differences between teams for TSAGAT and complimentary knowledge were statistically significant ($p < 0.05$). Mean checklist differences between teams also reached statistical significance ($p < 0.05$). TSAGAT scores correlated strongly with traditional checklist scores (Pearson correlation $r = 0.996$). Interrater reliability for the checklist tool was high (Pearson correlation $r = 0.937$). Conclusion TSAGAT is the first valid and reliable assessment tool incorporating SA and HPS for multidisciplinary team performance in trauma resuscitation. TSAGAT could compliment or improve on current assessment methods and curricula in trauma and critical care and provides a template for team assessment in other areas of surgical education.

**Publication type:** Journal: Article

**Source:** EMBASE

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**29. Title:** Using a situational awareness global assessment technique for interprofessional obstetrical team training with high fidelity simulation.

**Citation:** Journal of Interprofessional Care, January 2015, vol./is. 29/1(13-9), 1356-1820;1469-9567 (2015 Jan)

**Author(s):** Morgan P, Tregunno D, Brydges R, Pittini R, Tarshis J, Kurrek M, DeSousa S, Ryzynski A

**Language:** English

**Abstract:** Evidence suggests that breakdowns in communication and a lack of situation awareness contribute to poor performance of medical teams. In this pilot study, three interprofessional obstetrical teams determined the feasibility of using the situation awareness global assessment technique (SAGAT) during simulated critical event management of three obstetrical scenarios. After each scenario, teams were asked to complete questionnaires assessing their opinion of how their performance was affected by the introduction of questions during a SAGAT stop. Fifteen obstetrical professionals took part in the study and completed the three scenarios in teams consisting of five members. At nine questions per stop, more participants agreed or strongly agreed that there were too many questions per stop (57.1%) than when we asked six questions per stop (13%) and three questions per stop (0%). A number of interprofessional differences in response to this interprofessional experience were noted. A team SAGAT score was determined by calculating the proportion of correct responses for each individual. Higher scores were associated with better adherence to outcome times, although not statistically significant. A robust study design building on our pilot data is needed to probe the differing interprofessional perceptions of SAGAT and the potential association between its scores and clinical outcome times.

**Publication type:** Journal Article

**Source:** MEDLINE

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