



CSMEN – Simulation Publications Update

Bulletin December 2020

Surgery and the Use of Simulation

Welcome to the Simulation Publications Update a service brought to you by CSMEN in partnership with NES Knowledge Services.

The focus for this Simulation bulletin is on how simulation is used in Surgery. These articles may be of interest or relevance to your current role in NHS Scotland. The articles may also be of use in your research. These articles are from those journals we currently subscribe to. If there are any articles or journals that you would like us to add/consider please let us know.

Until now we have tried to provide approximately 30 links to articles on all aspects of simulation. We are now moving to shorter bulletins focusing on different aspects of simulation. The articles identified those which used simulation for surgical training. If you would like to suggest a focus topic or become a reviewer, please also let me know. Jean.ker@nes.scot.nhs.uk. The plan is to widen this service to focus on topic areas and to monitor its use and effectiveness so feedback would be much appreciated. This bulletin has been developed by Jean Ker clinical lead CSMEN in partnership with Alan Gillies from NES Knowledge Services.

Access to Journals

Different journals have different processes for login so please follow the instructions for accessing the full text of the articles through the links provided. On your behalf NES Knowledge Services subscribes to some journals direct and others via aggregators (i.e. journal collections or full text databases). We use something called a 'link resolver' to link you via the best route using your NHS Scotland OpenAthens password. Some journals can detect that you're logging in from NHS premises, so won't ask for the OpenAthens password, but if you're accessing from home you may have to login. None of the links should require you to set up a separate login – where there are login boxes for personal accounts, look for an OpenAthens or 'institutional login' option as well, which will accept your OpenAthens password.



Focus: Surgery and Use of Simulation based Education

[Virtual surgical training during COVID-19: Operating room simulation platforms accessible from home.](#) McKechnie, T., et al, Annals of Surgery, e153-e154. 2020.

In this bulletin there is a focus on articles where simulation in its many forms is being explored to enhance either the training experience or performance. Increasingly the use of artificial intelligence and virtual reality are being incorporated into the training programme of many surgical specialties. There is also a useful Delphi study identifying priorities for research in surgical simulation.

The recent Covid-19 pandemic has provided further hurdles in both enhancing performance and preventing skill decay across all areas of surgical practice. The impact of cancelled elective lists and the reduction in operative exposure is having a specific impact on those in surgical training.

This article by McKechnie et al provides a useful overview of the available computer and phone based platforms available and accessible from home which will support the learning needs of trainees as defined by governing bodies.

Computer based platforms

There are over 20 platforms reported as available with 15 freely accessible.

The Journal of Medical Insight is a peer reviewed surgical video journal that offers annotated intraoperative videos but costs \$500 per year.

Incision Academy is a European based online platform that presents live intraoperative videos. With these comes relevant anatomy, the step by step guidance on the operation and evidence from literature. This has been the first platform to receive RCSE Surgical Education centre approval and was offering a 4 week free trial in light of the current pandemic.

Live webinars and conference broadcasts are available through WebSurg as well as over 2000 sequenced intraoperative videos on general surgery and gynaecology.

Ortho Oracle is a UK based platform for orthopaedics and eIntegrity is a paid platform for ophthalmology sponsored by the NHS and the Royal College.

Phone based platforms

Touch surgery is a free trial phone surgical application which covers many specialties which has 200 procedures and a self assessment component. It has been validated by 19 independent peer reviewed publications.

Lapguru Orthoguru and My Virtual Surgery are other phone applications mentioned but there is little information or evidence on their use.

This article is helpful in bringing some of the applications to attention but in many examples there is not an evaluation of their use using any recognized criteria.

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Simulation in urological training and education (SIMULATE): Protocol and curriculum development of the first multicentre international randomized controlled trial assessing the transferability of simulation-based surgical training.

Aydin A., et al, BJU International, Vol 126, 1, 202-211. 2020.

This article reports the study protocol for the first international multicentre randomized controlled trial investigating the effectiveness of simulation-based surgical training and the development process for an evidence-based training curriculum, to be delivered as an educational intervention.

Use of simulation in plastic surgery training.

Agrawal, N., et al, Plastic and Reconstructive Surgery - Global Open, Vol 8, 7, e2896. 2020.

This article reviews the current state of simulation in craniofacial, hand, microvascular, and esthetic surgery and discuss applications for the future. It also discusses the evolving role of artificial intelligence, virtual reality, and augmented reality in plastic surgery training and testing.

Current status of wet lab and cadaveric simulation in urological training: A systematic review,

Al-Jabir, A., et al, Canadian Urological Association Journal, 2020.

The authors present a systematic review on the use of wet lab (animal and cadaveric) simulation models in urological training. 43 articles met the inclusion criteria. The authors conclude that simulation in urological education is becoming more prevalent in the literature, however, there is a focus on animal rather than cadaveric simulation, possibly due to cost and ethical considerations. Studies are also predominately of a low level of evidence.

Use of a low-cost portable 3D virtual reality gesture-mediated simulator for training and learning basic psychomotor skills in minimally invasive surgery: Development and content validity study.

Alvarez-Lopez, F., et al, Journal of Medical Internet Research, e17491. 2020.

Simulation in virtual environments has become a new paradigm for surgeon training in minimally invasive surgery (MIS). However, this technology is expensive and difficult to access. This study aims first to describe the development of a new gesture-based simulator for learning skills in MIS and, second, to establish its fidelity to the criterion and sources of content-related validity evidence. A good enough prototype of a gesture-based simulator was developed with metrics and feedback for learning psychomotor skills in MIS. All 30 participants felt that most aspects of the simulator were adequately realistic and that it could be used as a tool for teaching basic psychomotor skills in laparoscopic surgery. The sources of content-related validity evidence showed that this study's simulator is a reliable training tool and that the exercises enable learning of the basic psychomotor skills required in MIS.

Experienced surgeons versus novice surgery residents: Validating a novel knot tying simulator for vessel ligation.

Amiel, I., et al, Surgery, 699-703. 2020.

A bench-top, knot-tying simulator with computer-acquired assessment was tested on expert surgeons and surgery residents at an academic medical center during the years 2016 to 2018. Fifteen experienced surgeons and 30 surgery residents were recruited. The expert group exerted considerably less total force during placement of the knots than the novice residents and the peak force exerted upward was less in the expert group. The experts also completed the task in less time. The authors conclude that the simulator can offer residency programs a low-cost, bench-top platform to train and assess objectively the knot-tying capabilities of surgery residents.

Feedback based simulator training reduces superfluous forces exerted by novice residents practicing knot tying for vessel ligation.

Amiel, I., et al, American Journal of Surgery, 100-104. 2020.

A novel low-cost bench-top simulator with auditory and visual feedback that measures forces



exerted during knot tying was tested on 14 surgical residents. Pre- and post-training values for total force exerted during knot tying, maximum pulling and pushing forces and completion time were compared. Mean time to reach proficiency during training was 11:26 min, with a mean of 15 consecutive knots. Mean total applied force for each knot were 35% lower post-training than pre-training. Mean upward peak force was significantly lower after training. The authors conclude that simulator training with visual and auditory force feedback improves knot-tying skills of novice surgeons.

Priorities in surgical simulation research: What do the experts say?. Anton, N.E., et al, American Journal of Surgery, 95-99. 2020.

The purpose of this study was to establish contemporary research priorities utilizing Delphi methodology. Surgical researchers with expertise in simulation-based research were invited to submit important questions for the field according to an organized framework. A prioritized agenda was then created. In the final round, experts rated the following question as the most important priority: "Does demonstrated competency in the simulation lab translate to clinical competency (OR etc.)?"

Development and validation of metric-based-training to proficiency simulation curriculum for upper gastrointestinal endoscopy using a novel assessment checklist. Azzam N., et al, Saudi Journal of Gastroenterology, Vol 26, 4, 179-187. 2020.

This study aimed to design a structured simulation training curriculum for upper endoscopy and validate a new assessment checklist. The authors conclude that the Fundamentals of Gastrointestinal Endoscopy simulation training curriculum and its Simulation Endoscopic Skill Assessment Score (SESAS) global assessment tool have been primarily validated and can serve as a valuable addition to the gastroenterology fellowship programs.

Training novice robot surgeons: Proctoring provides same results as simulator-generated guidance. Beulens, A.J.W., et al, Journal of Robotic Surgery, 2020.

This study aimed to understand the influence of proctored guidance versus simulator generated guidance (SGG) on the acquisition dexterity skills in novice surgeons learning RAS (robot assisted surgery). Prospective non-blinded 3-arm randomised controlled trial (RTC). The participants were assigned to three different intervention groups and received a different form of guidance: (1) proctored guidance, (2) simulator generated guidance, (3) no guidance, during training on virtual reality (VR) simulator. There was no significant difference in the improvement of surgical skills between the three different intervention groups. The proctored guidance group reported a higher participant satisfaction compared to the simulator-generated guidance group. The authors conclude that the exposure to the robotic surgery simulator alone could possibly be sufficient to achieve a significant improvement of dexterity skills during the initial steps of RAS learning.

Randomized trial of a virtual reality tool to teach surgical technique for tibial shaft fracture intramedullary nailing. Blumstein G., et al, Journal of Surgical Education, Vol 77, 4, 969-977. 2020.

This study involve a simulated intramedullary nailing (IMN) of a tibia to demonstrate VR training programs as a more effective modality of learning orthopedic surgical techniques compared to passive learning tools such as a standard guide (SG) through trained novice medical students performing a SawBones simulation of intramedullary nail fixation. VR training was more effective than a passive SG in this model of simulated tibia IMN for novice medical students.



[Development and validation a task-specific checklist for a microsurgical varicocelectomy simulation model.](#) Campos M.E.C., et al, International Braz J Urol : Official Journal of the Brazilian Society of Urology, Vol 46, 5, 796-802. 2020.

This study aimed to develop and validate a new test of specific technical skills required for microsurgical varicocelectomy. An electronic questionnaire was sent to 558 members of the Brazilian Society of Urology for the validation of the task-specific checklist (TSC) for assessment of microsurgical varicocelectomy. Participants who had experience in this procedure were selected as judges. The final version of the TSC was comprised of the task-specific score, a series of 4 items scored in a binary fashion designed for microscopic sub-inguinal varicocelectomy. This preliminary study suggests that the task-specific checklist of microsurgical varicocelectomy is reliable and valid in assessing microsurgical skills.

[Simulation training in urology: State of the art and future directions,](#) Canalichio, K.L., et al, Advances in Medical Education & Practice, Vol 11, 391-396. 2020.

There has been a major shift from the old paradigm of 'see one, do one, teach one' in medical training due in large part to resident work-hour restrictions and required oversight in the operating room. Advancements in technology have allowed for the introduction of more objective measures to assess the skill competency and proficiency of surgical trainees. Urology is uniquely positioned at the forefront of new emerging technologies in surgery, because of the field's commitment to safe and efficient minimally invasive surgery and endourological procedures. Due to these technically challenging procedures, urological training must incorporate these educational technologies to allow for objective skills assessment, skills transfer, and ultimately providing optimal patient care with the production of proficient and competent urological trainees.

[A novel simulated training platform and study of performance among different levels of learners in flexible cystoscopy.](#) CantillonMurphy P., et al, Simulation in Healthcare : Journal of the Society for Simulation in Healthcare, Vol 15, 3, 214-220. 2020.

The aims of this study were to test a novel simulation platform suitable for flexible cystoscopy using a standard scope, to assess the platform's proposed use as a training tool for flexible cystoscopy, and to assess the user experience through surveyed response. Thirty-one urologists (11 novices, 20 experts) were evaluated using a novel light-based bladder model and standard flexible cystoscope. All participants ranked the tool as very good or excellent for overall quality of training. The authors conclude that, in providing a quantifiable measure of user performance, the tool may shorten the learning curve and, potentially, reduce clinical errors and provide quantifiable measures for further clinical training.

[Robotic surgical training at home: A low-fidelity simulation method.](#) Cruff, J., Journal of Surgical Education, 2020.

Laparoscopic box simulators provide surgical residents a cost-effective and accessible learning tool to practice basic laparoscopic skills. Despite effective, high-fidelity simulators used in robotic surgery training, a similar low-fidelity alternative simulation method is not available. The objective of this report and accompanying video is to introduce a low-fidelity method to help those new to robotic-assisted surgery learn fundamental skills even before sitting at the console. Using 2 fine-point metal tweezers with Velcro loops for finger slots, the author developed a user-friendly way to practice basic needle handling and intracorporeal knot tying activities similar to those encountered on a high-fidelity robotic simulator.



[Training and learning curves in minimally invasive pancreatic surgery: From simulation to mastery.](#)

Haney C.M., et al, Journal of Pancreatology, Vol 3, 2, 101-110. 2020.

Minimally invasive pancreatic surgery (MIPS) has developed over the last 3 decades and is experiencing an increased interest from the surgical community. For implementation of MIPS the authors propose 3 training phases: 1) developing basic skills and procedure specific skills with the help of simulation, biotissue drills, video libraries, live case observations, and training courses; 2) index procedures, fellowships, and proctoring programs to ensure patient safety during the first procedures; 3) safely implement the procedure into standard practice while minimizing learning curve related excess morbidity and mortality. The residual learning curve can reach up to 100 cases depending on the surgeons' previous experience, selection of cases, and definition of the parameters used to assess the learning curve.

[Simulation in surgical trauma training.](#) Kelley K. & Park, H., Current Surgery Reports, Vol 8, 7 Article Number: 13. 2020.

This review details ways in which simulation is used in current surgical trauma training. Recent There have been new developments in specific simulation techniques used in existing training programs. Additionally, there is ongoing development of more advanced simulation utilizing virtual reality training. Simulation is incorporated in surgical trauma training in a variety of ways. It is used for specific surgical techniques, it is included in several national trauma courses, it is used for team training, and it is used to teach communication skills. There are continued advances being made in the area of surgical trauma simulation including the use of virtual reality.

[Virtual surgical training during COVID-19: Operating room simulation platforms accessible from home.](#)

McKechnie, T., et al, Annals of Surgery, e153-e154. 2020.

The aim of this article is to provide an overview of the available computer- and phone-based platforms accessible at home for surgical trainees who currently have limited surgical exposure given the ongoing COVID-19 pandemic. It may help surgical trainees and surgical education governing bodies to initiate and create at-home surgical curricula during the COVID-19 pandemic.

[Virtual reality and augmented reality-translating surgical training into surgical technique.](#) McKnight

R.R., et al, Current Reviews in Musculoskeletal Medicine, 2020. 2020.

As immersive learning outside of the operating room is increasingly recognized as a valuable method of surgical training, virtual reality (VR) and augmented reality (AR) are increasingly utilized in orthopedic surgical training. This article reviews the evolving nature of these training tools and provides examples of their use and efficacy. The practical and ethical implications of incorporating this technology and its impact on both orthopedic surgeons and their patients are also discussed.

[The impact of surgical simulation on patient outcomes: A systematic review and meta-analysis.](#)

Meling, T.R., Neurosurgical Review, 2020.

The objective of this review was to investigate the effects of surgical simulation training on clinically relevant patient outcomes by evaluating randomized controlled trials (RCT). Nineteen papers were included - sixteen studies looked at surgical training, two studies assessed patient-specific simulator practice, and one paper focused on warming-up on a simulator before performing surgery. On average, the intervention group scored 0.42 points higher on a standardized GRS scale of 1-10. On average, the intervention group was 44% faster than the control group. Four papers assessed the impact of simulation training on patient outcomes, with only one finding a significant effect. The authors found a significant effect of simulation training on operative performance as assessed by GRS, albeit a small one, as well as a significant reduction to operative time. However, there is to



date scant evidence from RCTs to suggest a significant effect of surgical simulation training on patient outcomes.

Efficacy and validity of orthopaedic simulators in surgical training: A systematic review and meta-analysis of randomized controlled trials. Polce E.M., et al, The Journal of the American Academy of Orthopaedic Surgeons, 08 May 2020. 2020.

The purpose of this study was to perform a systematic review and meta-analysis of the effects of training simulators on surgical skill measures across randomized controlled trials. 24 studies with 494 participants were identified. The most common simulator type involved knee arthroscopy (11 studies, 45.8%). Overall, improved task efficiency and performance were observed with the use of orthopaedic simulators. However, simulator type, training protocols, and outcome measures were heterogeneous.

Surgical resident training in Pakistan and benefits of simulation based training. Zubair, U. & Zubair, Z., JPMA - Journal of the Pakistan Medical Association, Vol 70, 5, 904-908. 2020.

Simulation training is a time-effective method for training residents and is being used globally, but the majority of training hospitals in Pakistan have been using the apprenticeship model since it came into being. This review examined the results of studies comparing the efficacy of trainees trained via the traditional apprenticeship model versus simulator-based training and the authors argue for the use of simulation in Pakistan for training as well as assessment.