Supplementary Digital Content 6: Table of characteristics of included studies.

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| Author  Year  Country | Study design | Provider/learner | n | Procedure | Intervention | n | Translational Outcome measures |
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| Branzetti  2017  United States | Randomized control trial | Board certified or board eligible emergency medicine physicians | 26 | Transvenous pacemaker insertion | JIT intervention designed to run on a tablet to allow bedside implementation including first a 30-second refresher video of key steps followed by a step-by-step interactive checklist based on best-practice | 26 | T1: **Time to completion of TVP procedure**, Technical Skills Checklist Score, Behaviourally Anchored Rating Scale | JIT training |
| Calatayud  2010  Canada, Denmark & UK | Randomized  crossover trial | General surgery residents | 10 | Laparoscopic cholecystectomy | Warm up was completed on a virtual reality laparoscopic simulator and conducted for 15-minutes immediately before the actual operative procedure. | 20 | T2: **OSAT rating scale** | JIT training |
| Carlson  2021  United States | Before-after study | RN, PA/APRN, Physician/fellow, paramedic | 338 | Nasopharyngeal swab collection | Video instruction and two simulation stations consisting of nasopharyngeal models for practice collection | 338 | T2: **Knowledge,** Comfort level | JIT training |
| Chen  2013  United States | Randomized control trial | Obgyn residents of all levels | 37 | Nonemergency, laparoscopic benign gynecologic surgical cases | Warm-up had to perform three pre-assigned tasks once on a virtual TASKIT laparoscopic trainer immediately prior to the operation. | 91 | T2: **Reznick scale/modified OSATS**, Vassiliou scale, Kundhal scale | JIT training |
| Cheng  2015  United States, Canada, UK | Randomized control trial | Medical students, resident and fellow physicians, nurses and nurse practitioners | 93 | CPR skills | A 5-minute training video on CPR followed by 2 minutes of practice per team member with visual feedback | 93 | T1: Chest compression depth and the **proportion of CCs during each simulated arrest with depth exceeding 50mm** | JIT training |
| Curran  2004  Canada | Randomized control trial | 3rd year medical students | 60 | ANAKIN computerized neonatal manikin simulator | NRP tutorial using the ANAKIN system. | 60 | T1: multiple-choice test, **expert rated checklist** T2: self-reported confidence, | equivocal |
| da Cruz  2016  Brazil | Randomized control trial | Medical students in their final years of training with experience in laparoscopic principles | 20 | Laparoscopic cholecystectomy in a porcine model | Preoperative warm-up in a virtual reality surgical simulator. Involved 4 tasks – camera skill, clipping skill, cutting skill, and peg transfer skill each at 2 levels. | 20 | T1: Various time points (dissection of the pedicle of the gallbladder, clipping of the pedicle, pedicle section, gallbladder removal, **total procedure time** T2: the aspirated blood volume in porcine model, global performance assessment using GOALS | Equivocal (prioritized total operative time) |
| Desender  2016  Belgium, Netherlands, Switzerland, UK | Randomized  control trial | Lead implanter, assistant, and scrub nurse | UKN | Endovascular aortic aneurysm repair (EVAR) | Interventional team carried out pre-operative rehearsal using a VR simulator and 3D generated model within 24 hours of the actual procedure | 100 | T2: errors during EVAR, T3: **in-hospital mortality**, 30-day mortality, | JIT training |
| Deuchler  2016  Germany | Randomized control trial | Practicing vitreoretinal surgeons | 4 | Vitrectomy | ~20 minute Pre-op warm up on a simulator training including an abstract bimanual task, two peeling (non-dominant and dominant hand) and a simulated retinal detachment surgery | 21 | T2: **Global Rating Assessment of Skills in Intraocular Surgery** | JIT training |
| Do  2006  United States | Before-after study | Obgyn residents and third-year medical students | 24 | Laparoscopic simulator | All participants completed a 10-minute transfer task in a laparoscopic simulator as warm up, then repeated the exercise following a 5 min pause. | 24 | T1: **Laparoscopic proficiency score** | JIT training |
| Hein  2010  Australia | Randomized control trial | A convenience sample of Bachelor of Health Sciences Paramedic undergraduate degree program students | 55 | LMA insertion | Similar to the initial training program including watching an insertion video and having 10 minutes of unsupervised practice on 3 different partial task trainers | 55 | T1: **Time to insertion** | JIT training |
| Itoh  2019  United States | Before-after study | Trainees including fourth year medical students, postgraduate year 1-3 family medicine residents and postgraduate year 1-3 pediatric residents who rotated through a pediatric emergency department | 34 | Intraosseous insertion and defibrillation | Attending ED physician facilitated and 10-20 minute session which reviewed the indications & contraindications along with steps for IO placement and also reviewed the location and steps for use of the defibrillator. Trainees were able to perform hands-on. Facilitated on every clinical shift when allowed by patient volume | 65 | T1: Satisfaction; **knowledge** | JIT training |
| Kahol  2009  United States | Comparative study | Surgical trainees in obgyn and general surgery; Attending trauma surgeons | 46; 12 | Laparoscopic exercises | Only Experiment 2: participants assigned to intervention performed three warm-up exercises on a laparoscopic trainer that were randomly selected from the eight exercises previously | 112 | T1: gesture-level proficiency, hand-movement smoothness, tool-movement smoothness, time elapsed, and cognitive errors | JIT training |
| Kessler  2015  United States | Before-after study | Incoming postgraduate year 1 trainees from pediatric or emergency medicine residency programs | 1319 | Lumbar puncture (LP) | 5 – 10 min just-in-place training sessions with clinical supervisor immediately before their first clinical LP | 436 | T2: **first-attempt infant LP success rate,** number of attempts | Equivocal |
| Kroft  2012  Canada | Randomized crossover design | Obgyn residents at PGY-2 level and above | 13 | Laparoscopic simulator | Use of a laparoscopic bench model to practice intracorporeal suturing for 15 min | 26 | T1: **intracorporeal suturing task score** | Equivocal |
| Lee  2012  United States | Randomized crossover design | Urology residents and fellows PGY3 and above | 7 | Laparoscopic radical and partial nephrectomy, dismembered pyeloplasty, renal cyst decortication | 5 min of electrocautery simulation task training on virtual reality surgical simulator and 15 min of laparoscopic suturing on basic laparoscopic pelvic box trainer approximately 1 h prior to surgery | 28 | T2: Cognitive, psychomotor information, and technical performance. Operative assessment tool modified for laparoscopic renal surgery, **time to mobilisation of the colon**, time for intracorporeal suturing and knot tying | Equivocal |
| Lendvay  2013  United States | Randomized  control trial | Faculty in general surgery, urology and gynaecology including post-graduate trainees. | 51 | Robotic surgery on a simulator | Warm-up consisting of performing the pegboard virtual reality task immediately before the trial sessions | 204 | T1: **Total task time**, cognitive errors and economy of motion | JIT training |
| Lum  2021  United States | Before-after study | Residents, physicians, nurses and respiratory therapists | unknown | Pediatric intubation | 15 minute video laryngoscopy JIT training with hands-on simulated practice during regular work hours | 268 | T2: intubations with multiple attempts and adverse events related to intubation | Equivocal |
| Moldovanu  2011  Romania | Randomized  control trial | Surgeon | 1 | Laparoscopic cholecystectomy | 15 min of virtual reality training of three tasks, immediately prior to surgery | 20 | T2: **Global rating scale** | Equivocal |
| Moran-Atkin  2015  United States | Randomized  control trial | General surgery trainees and minimally invasive surgical fellows | 20 | Laparoscopic cholecystectomy, appendectomy, hernia repair, colon resection, sleeve gastrectomy, Roux-en Y gastric bypass | Warm up group completed peg transfer, pattern cutting, endoloop, and intracorporeal suturing as warm-up exercises | 40 | T2: **Reznick global rating scale**, Vassiliou global rating scale | Equivocal |
| Mucksavage  2012  United States | Before-after study | Attending surgeon | 1 | Laparoscopic partial and radical nephrectomies | 15-20 min of training using pelvic suturing exercises, prior to surgery | 75 | T2: Intraoperative parameters, including **total operative time**, surgical time, estimated blood loss, warm ischemia time, complicationsand positive margin rates  T3:postoperative parameters, including total length of stay, changes in post-operative hemoglobin and creatinine levels, morphine equivalents T4: weighted average cost per minute of operating room time was calculated | JIT |
| Navaneethan  2015  Australia | Randomized control trial | Surgeons, surgical trainees, and medical students | 44 | Laparoscopic simulator | 10 min warm up applying a paper clip chain on pegs in a laparoscopic trainer | 44 | T1: **Average speed/time**, acceleration, smoothness | Equivocal |
| Nishisaki  2010  United States | Before-after study | Residents, nurses and respiratory therapists | 200 | Orotracheal intubation | 20 min multidisciplinary simulation-based tracheal intubation training and 10-min resident skill refresher training at the beginning of their on-call period | 401 | T2: **First-attempt success of orotracheal intubation** | Equivocal |
| Qiao  2019  China | Randomized control trial | Craniofacial surgery fellow physicians | 15 | Mandibular contour surgery | All participants completed 5 training session on the mandibular contour surgery training model before surgery | 90 | T2: Self-rated level of operating confidence, **Surgical time**, surgical accuracy T3: Patient satisfaction of their surgical outcome | JIT training |
| Rosser  2012  United States | Comparative study | Surgeons and surgical residents | 303 | Laparoscopic simulator | Warm up of playing 3 previously validated video games for 6-mins each immediately before performing the task was introduced | 1073 | T1: **Average time to complete task** | JIT training |
| Scholtz  2013  United States | Before-after study | Nurses on all units who were projected to have a CVC dressing change | 524 | CVC dressing change | CVC dress rehearsal with debriefing | 2469 | T1: provider knowledge and psychomotor performance during CVC dressing change on mannequin; T2: provider self-confidence, clinical performance during CVC dressing change on patients; T3: **clinical impact through hospital-wide CLABSI rate**. | JIT training |
| Weston  2014  Australia | Randomized control trial | Surgeons and trainee surgeons | 13 | Laparoscopic cholecystectomy, laparoscopic appendectomy | Complete intracorporeal suturing exercises for 10 min on laparoscopic trainer box  -10 minutes play car-race game on a PlayStation 2 gaming console | 75 | T2: Global operative assessment of laparoscopic skills (GOALS), separation of appendix, application of endoloops, running of the small bowel, dissection of cystic duct and artery, separation of gall bladder from gall bladder fossa, **total time** | Equivocal |
| Zucco  2022  United States | Before-after study | Anesthesia, surgery physicians, nursing, OR attendants, technicians, anesthesia providers | 428 | Workflow changes necessitated by the COVID-19 pandemic | In situ simulation training: pre-operative huddle, OR setup, donning and doffing of PPE, transferring patients, airway management | 110 | T1: Post simulation training survey | JIT training |

CPR – cardiopulmonary resuscitation, CVC – central venous catheter, ObGyn – Obstetrics and Gynecology, PGY – postgraduate year, UKN.- Unknown, PA/APRN – Physician Assistant/Advanced Practice Registered Nurse, COVID-19 – coronavirus-19, PPE – personal protective equipment