

Enhancing UK Core Medical Training through simulation-based education: an evidence-based approach

Full systematic review results



Full systematic review results

Common competencies					
Competency	Study Title	Evidence outcome level	Undergraduate / postgraduate	Positive / negative / neutral	Specialty
Clinical examination	Simulation training improves diagnostic performance on a real patient with similar clinical findings (Fraser et al., 2011)	T2	Undergraduate	Positive	-
Decision making and clinical reasoning	Anesthesia crisis resource management training: teaching anesthesiologists to handle critical incidents (Howard et al., 1992)	T1	Postgraduate	Positive	Anaesthetics
Relationships with patients and communication within a consultation	Efficacy of a Cancer Research UK communication skills training model for oncologists: a randomised controlled trial (Fallowfield et al., 2002)	T2	Postgraduate	Positive	Oncology
Breaking Bad News	Efficacy of a Cancer Research UK communication skills training model for oncologists: a randomised controlled trial (Fallowfield et al., 2002)	T2	Postgraduate	Positive	Oncology
	Breaking bad news education for emergency medicine residents: A novel training module using simulation with the SPIKES protocol (Park et al., 2010)	T1	Postgraduate	Positive	Emergency Medicine
	Ability of primary care physicians to break bad news: A performance based assessment of an educational intervention (Amiel et al., 2006)	T1	Postgraduate	Positive	Primary care physicians
	Teaching breaking bad news using mixed reality simulation (Bowyer et al., 2010)	T1	Undergraduate	Positive	-
	An interactive educational workshop to improve end of life communication skills (Hales & Hawryluck, 2008)	T1	Postgraduate	Positive	ICU
	Improving Residents' End-of-Life Communication Skills with a Short Retreat: A Randomized Controlled Trial (Szmuiłowicz et al., 2010)	T1	Postgraduate	Positive	Internal Medicine

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	Training faculty to facilitate communication skills training: Development and evaluation of a workshop (Bylund et al., 2008)	T1	Postgraduate	Positive	Internal Medicine
	Combining High-Fidelity Human Patient Simulators with a Standardized Family Member: A Novel Approach to Teaching Breaking Bad News (Bowyer et al., 2006)	T1	Undergraduate	Positive	-
	Simulated parents: Developing paediatric trainees' skills in giving bad news (Gough et al., 2009)	T1	Postgraduate	Positive	Paediatrics
	Teaching Medical Students How to Break Bad News with Standardized Patients (Kiluk et al., 2012)	T1	Undergraduate	Positive	-
	Development and Evaluation of a Program to Strengthen First Year Residents' Proficiency in Leading End-of-Life Discussions (Williams et al., 2011)	T1	Postgraduate	Positive	Internal Medicine
	Efficacy of Communication Skills Training for Giving Bad News and Discussing Transitions to Palliative Care (Black et al., 2007)	T1	Postgraduate	Positive	Medical Oncology
	Efficacy of a Cancer Research UK communication skills training model for oncologists: a randomised controlled trial (Fallowfield et al., 2002)	T2	Postgraduate	Positive	Oncology
	A Controlled Trial of a Short Course to Improve Residents' Communication With Patients at the End of Life (Alexander et al., 2006)	T1	Postgraduate	Positive	Internal Medicine
Communication within a consultation	Teaching consultation skills in higher specialist training: experience of a workshop for specialist registrars in rheumatology (Cooper & Hassell, 2002)	T1	Postgraduate	Positive	Rheumatology
	Using Simulated Consultations to Develop Communication Skills for Neurology Trainees (Smith et al., 2002)	T1	Postgraduate	Positive	Neurology
	Training physicians in communication skills with adolescents using teenage actors as simulated patients (Hardoff D, 2001)	T1	Postgraduate	Positive	Primary care physicians
	Human Emotion and Response in Surgery (HEARS): A Simulation-Based Curriculum for Communication Skills, Systems-Based Practice, and Professionalism in Surgical Residency Training (Larkin et al., 2010)	T1	Postgraduate	Positive	Surgery
	Use of an innovative video feedback technique to enhance communication skills training (Roter et al., 2004)	T1	Postgraduate	Positive	Paediatrics

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	The use of virtual patients to teach medical students history taking and communication skills (Stevens et al., 2006)	T1	Undergraduate	Positive	-
	Improving residents' code status discussion skills: a randomized trial (Szmuilowicz et al., 2012)	T1	Postgraduate	Positive	Internal Medicine
	Effect of Communication Skills Training for Residents and Nurse Practitioners on Quality of Communication With Patients With Serious Illness: A Randomized Trial (Curtis et al., 2013)	T2	Postgraduate	Neutral	Internal Medicine
	Crisis resource management training for an anaesthesia faculty: a new approach to continuing education (Blum et al., 2003)	T1	Postgraduate	Positive	Anaesthesia
Team working	Use of High Fidelity Operating Room Simulation to Assess and Teach Communication, Teamwork and Laparoscopic Skills: Initial Experience (Gettman et al., 2009)	T1	Postgraduate	Positive	Urology
	Crisis resource management training for an anaesthesia faculty: a new approach to continuing education (Blum et al., 2003)	T1	Postgraduate	Positive	Anaesthesia
	Survey of change in practice following simulation-based training in crisis management (Weller et al., 2003)	T1	Postgraduate	Positive	Anaesthesia
Complaints and medical error	Teaching medical error disclosure to residents using patient-centred simulation training (Sukalich et al., 2014)	T1	Postgraduate	Positive	GIM

Emergency presentations

Competency	Study Title	Evidence Level	Undergraduate / post graduate	Positive / negative / neutral	Specialty
Cardio-Respiratory arrest	Simulation-Based Education Improves Quality of Care During Cardiac Arrest Team Responses at an Academic Teaching Hospital (Wayne, Didwania, et al., 2008)	T1	Postgraduate	Positive	Internal Medicine
	A Longitudinal Study of Internal Medicine Residents' Retention of Advanced Cardiac Life Support Skills (Wayne et al., 2006)	T1	Postgraduate	Positive	Internal Medicine
	Simulation-based mock codes significantly correlate with improved pediatric patient cardiopulmonary arrest survival rates (Andreatta et al., 2011)	T3	Postgraduate	Positive	Paediatrics
	Improved performance of maternal-fetal medicine staff after maternal cardiac arrest simulation-based training (Fisher et al., 2011)	T1	Postgraduate	Positive	Obstetrics & Gynaecology
	Use of a computerized advanced cardiac life support simulator improves retention of advanced cardiac life support guidelines better than a textbook review (Schwid et al., 1999)	T1	Postgraduate	Positive	Anaesthesia
	Effect of Advanced Cardiac Life Support Training on Resuscitation Efforts and Survival in a Rural Hospital (Camp et al., 1997)	T2	Postgraduate	Neutral	Physicians
	Emergency medicine resident crisis resource management ability: a simulation-based longitudinal study (Clarke et al., 2014)	T1	Postgraduate	Positive	Emergency Medicine
	Simulation technology for resuscitation training: A systematic review and meta-analysis (Mundell et al., 2013)	T3	Postgraduate	Positive	Mixed
Anaphylaxis	Prospective Randomized Crossover Study of Simulation vs. Didactics for Teaching Medical Students the Assessment and Management of Critically Ill Patients (McCoy et al., 2011)	T1	Undergraduate	Positive	-

	Treatment of a simulated child with anaphylaxis: An in situ two-arm study (O'Leary et al., 2013)	T1	Postgraduate	Positive	Paediatric emergency medicine
	Using Simulation to Assess Radiology Resident Preparedness for Anaphylaxis from Intravenous Contrast Media (Gaca et al., 2007)	T1	Postgraduate	Positive	Radiology
	Clinical decision-making augmented by simulation training: neural correlates demonstrated by functional imaging: a pilot study (Goon et al., 2014)	T1	Undergraduate	Positive	-
	Simulation-Based Education Is an Effective Teaching Tool for Pediatric Trainees, in the Diagnosis and Management of Pediatric Anaphylaxis (Miller et al., 2013)	T1	Postgraduate	Positive	Paediatric
Shocked patient	Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills (Steadman et al., 2006)	T1	Undergraduate	Positive	-
	Use of a fully simulated intensive care unit environment for critical event management training for internal medicine residents (Lighthall et al., 2003)	T1	Postgraduate	Positive	Internal medicine
	High-fidelity simulation is superior to case-based discussion in teaching the management of shock (Littlewood et al., 2013)	T1	Undergraduate	Positive	-
	An educational course including medical simulation for early goal-directed therapy and the severe sepsis resuscitation bundle: An evaluation for medical student training (Nguyen et al., 2009).	T1	Undergraduate	Positive	-
Unconscious patient	Comparison of three simulation-based training methods for management of medical emergencies (Owen et al., 2006)	T1	Postgraduate	Positive	Trainee medical officers

Top presentations

Competency	Study Title	Evidence Level	Undergraduate/post graduate	Positive/negative	Specialty
Abdominal pain	Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills (Steadman et al., 2006)	T1	Undergraduate	Positive	Medical students
	Impact of Increased Authenticity in Instructional Format on Preclerkship Students' Performance: A Two-Year, Prospective, Randomized Study (LaRochelle et al., 2012)	T1	Undergraduate	Neutral	Medical students
Breathlessness	Simulation-based training is superior to problem-based learning for the acquisition of critical assessment and management skills (Steadman et al., 2006)	T1	Undergraduate	Positive	Medical students
Chest pain	Simulation training improves diagnostic performance on a real patient with similar findings (Fraser et al., 2011)	T2	Undergraduate	Positive	Medical students
	A randomized comparison trial of case-based learning versus human patient simulation in medical student education (Schwartz et al., 2007)	T1	Undergraduate	Neutral	Medical students
Palliative care (management of)	Death is not always a failure: outcomes from implementing an online virtual patient clinical case in palliative care (Tan et al., 2013)	T1	Undergraduate	Positive	Medical students
	Avatar-mediated training in the delivery of bad news in a virtual world (Andrade et al., 2010)	T1	Postgraduate	Positive	GIM trainees
	Computer-Based Simulation as a Teaching Tool for Residents Treating Patients With Cancer-Related Pain Crises (Harting et al., 2008)	T1	Postgraduate	Positive	GIM trainees

Investigations

Competency	Study Title	Evidence Level	Undergraduate/post graduate	Positive/negative	Specialty
Blood biochemistry	Virtual patient simulation: Knowledge gain or knowledge loss? (Botezatu et al., 2010)	T1	Undergraduate	Positive	Undergraduate
Blood haematology	Virtual patient simulation: Knowledge gain or knowledge loss? (Botezatu et al., 2010)	T1	Undergraduate	Positive	Undergraduate

Procedures

Competency	Study Title	Evidence Level	Undergraduate/post graduate	Positive/negative	Specialty
Intercostal drain insertion	Using simulation models to teach junior doctors how to insert chest tubes: A brief and effective teaching module (Hutton et al., 2008)	T1	Postgraduate	Positive	Internal medicine
	Validation of a novel resin-porcine thorax model for chest drain insertion training (Naicker et al., 2012)	T1	Postgraduate	Positive	Internal medicine
	An Innovative Non-animal Simulation Trainer for Chest Tube Insertion in Neonates (Ashish & Jayashree, 2014)	T1	Postgraduate	Positive	Paediatrics+Internal medicine
	The Use of Lambs Chests in Chest Drain Insertion Simulation (Nazerali-Maitland et al., 2011)	T1	Postgraduate	Positive	Internal medicine
	Experience of an intercostal chest drain training course in the Yorkshire and Humber postgraduate deanery (Esterbrook et al., 2011)	T1	Postgraduate	Positive	Internal medicine
	An Effective Training Program for Chest Tube Drainage for Medical Interns in a Clinical Simulation Laboratory (Yoshimura et al., 2012)	T1	Postgraduate	Positive	Internal Medicine
Lumbar puncture	Simulation-based education with mastery learning improves residents' lumbar puncture skills (J.H. Barsuk et al., 2012)	T1	Postgraduate	Positive	Internal medicine
	A Randomized Trial of Simulation-Based Deliberate Practice for Infant Lumbar Puncture Skills (Kessler et al., 2011)	T1	Postgraduate	Positive	Paediatrics
	Virtual Reality Simulator for the Training of Lumbar Punctures (Farber et al., 2009)	T1	Undergraduate	Positive	-
	Does Simulator Training for Medical Students Change Patient Opinions and Attitudes toward Medical Student Procedures in the Emergency Department (Graber et al., 2005)	T2	Undergraduate	Positive	-
	Evaluation of M43B Lumbar puncture simulator-II as a training tool for identification of the epidural space and lumbar puncture (Uppal et al., 2011)	T1	Postgraduate	Positive	Anaesthesia
	Transfer of simulated lumbar puncture training to the clinical setting (White et al., 2012)	T2	Postgraduate	Positive	Paediatric + Internal Medicine
	Designing training models for lumbar puncture and spinal anaesthesia for the first time in Iran and using them in numerous training workshops (Afhami, 2013)	T1	Undergraduate	Positive	-

	Directed self-regulated learning versus instructor regulated learning in simulation training (Brydges et al., 2012)	T1	Postgraduate	Positive	Internal Medicine
DC cardioversion	Teaching antiarrhythmic therapy and ECG in simulator-based interdisciplinary undergraduate medical education (Mueller et al., 2005)	T1	Undergraduate	Positive	-
	Recognition and Treatment of Unstable Supraventricular Tachycardia by Pediatric Residents in a Simulation Scenario (Shilkofski et al., 2008)	T1	Postgraduate	Positive	Paediatric
	A low-fidelity simulation curriculum addresses needs identified by faculty and improves the comfort level of senior internal medicine resident physicians with in-hospital resuscitation (Healey et al., 2010)	T1	Postgraduate	Positive	Internal Medicine
Central venous catheterisation (CVC)	Simulation Training and Its Effect on Long-Term Resident Performance in Central Venous Catheterization (Smith et al., 2010)	T2	Postgraduate	Neutral	Internal Medicine
	Use of Simulation-Based Education to Reduce Catheter-Related Bloodstream Infections (Barsuk, Cohen, et al., 2009)	T3	Postgraduate	Positive	Internal medicine+ Emergency medicine
	Mastery Learning of Temporary Hemodialysis Catheter Insertion by Nephrology Fellows Using Simulation Technology and Deliberate Practice (Barsuk, Ahya, et al., 2009)	T1	Postgraduate	Positive	Nephrology (Internal Medicine)
	Simulation Training in Central Venous Catheter Insertion: Improved Performance in Clinical Practice (Evans et al., 2010)	T2	Postgraduate	Positive	Internal Medicine
	Cost Savings From Reduced Catheter-Related Bloodstream Infection After Simulation-Based Education for Residents in a Medical Intensive Care Unit (Cohen et al., 2010)	T3	Postgraduate	Positive	Internal Medicine
	Improving internal medicine residents' performance, knowledge, and confidence in central venous catheterization using simulators (Millington et al., 2009)	T1	Postgraduate	Positive	Internal Medicine
	Performance of Medical Residents in Sterile Techniques During Central Vein Catheterization: Randomized Trial of Efficacy of Simulation-Based Training (Khouli et al., 2011)	T3	Postgraduate	Positive	Internal Medicine
	Simulation Training for Pediatric Residents on Central Venous Catheter Placement: A Pilot Study (Thomas et al., 2013)	T1	Postgraduate	Positive	Paediatric
	A Prerotational, Simulation-Based Workshop Improves the Safety of Central Venous Catheter Insertion: Results of a Successful Internal Medicine House Staff Training Program (Sekiguchi et al., 2011)	T3	Postgraduate	Positive	Internal Medicine

	Prevention of central venous catheter-related bloodstream infections: is it time to add simulation training to the prevention bundle? (Burden et al., 2012)	T3	Postgraduate	Positive	Internal Medicine
	Teaching Aseptic Technique for Central Venous Access Under Ultrasound Guidance: A Randomized Trial Comparing Didactic Training Alone to Didactic Plus Simulation-Based Training (Latif et al., 2012)	T1	Postgraduate	Positive	Internal Medicine/Anaesthesia
	Sustainability Of Improvement After Central Line Simulation Training (Hicks et al., 2013)	T1	Postgraduate	Positive	Internal Medicine
	Central line simulation: a new training algorithm (Britt et al., 2007)	T1	Postgraduate	Positive	Surgery
	Effectiveness of a novel training program for emergency medicine residents in ultrasound-guided insertion of central venous catheters (Woo et al., 2009)	T1	Postgraduate	Positive	Emergency Medicine
Pleural aspiration	Learning curves and long-term outcome of simulation-based thoracentesis training for medical students (Jiang et al., 2011)	T2	Undergraduate	Positive	-
	Mastery learning of thoracentesis skills by internal medicine residents using simulation technology and deliberate practice (Wayne, Barsuk, et al., 2008)	T1	Postgraduate	Positive	Internal Medicine
	Reducing Iatrogenic Risk in Thoracentesis: Establishing Best Practice Via Experiential Training in a Zero-Risk Environment (Duncan et al., 2009)	T3	Postgraduate	Positive	Internal Medicine
	Multipurpose Simulator for Technical Skill Development in Thoracic Surgery (Carter et al., 2010)	T1	Undergraduate	Positive	-
	The Use of a Simulation Center to Improve Resident Proficiency in Performing Ultrasound-Guided Procedures (Mendiratta-Lala et al., 2010)	T1	Postgraduate	Positive	Radiology
Abdominal Paracentesis	Simulation-Based Education with Mastery Learning Improves Paracentesis Skills (J. Barsuk et al., 2012)	T1	Postgraduate	Positive	Internal Medicine
	The Use of a Simulation Center to Improve Resident Proficiency in Performing Ultrasound-Guided Procedures (Mendiratta-Lala et al., 2010)	T1	Postgraduate	Positive	Radiology
	Cost Savings of Performing Paracentesis Procedures at the Bedside After Simulation-based Education (Barsuk et al., 2014)	T3	Postgraduate	Positive	Internal Medicine
Knee Aspiration	An Instructional Program to Facilitate Teaching Joint/Soft-tissue Injection and Aspiration (Vogelgesgang et al., 2002)	T1	Postgraduate & Undergraduate	Positive	Internal Medicine

	Influence of an interactive joint model injection workshop on physicians' musculoskeletal procedural skills (Jolly et al., 2007)	T1	Postgraduate	Positive	Internal Medicine
	A Comparison of Arthrocentesis Teaching Tools: Cadavers, Synthetic Joint Models, and the Relative Utility of Different Educational Modalities in Improving Trainees' Comfort With Procedures (Berman et al., 2012)	T1	Postgraduate	Positive	Internal Medicine (Rheumatology)
	A structured course teaching junior doctors invasive medical procedures results in sustained improvements in self-reported confidence (Garrod et al., 2010)	T1	Postgraduate	Positive	Internal Medicine+FY
	Teaching knee joint aspiration to medical students—an effective training with long-term benefits (Watson et al., 2010)	T1	Undergraduate	Positive	-
Nasogastric tube insertion	The benefit of repetitive skills training and frequency of expert feedback in the early acquisition of procedural skills (Bosse et al., 2015)	T1	Undergraduate	Positive	

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