

## IN PRACTICE

A8

**BLENDING IN-SITU SIMULATIONS WITH SAFETY-II THEORY: THE IDENTIFICATION OF RISK AND SYSTEM IMPROVEMENT OPPORTUNITIES BEFORE MOVING INTO A NEW EMERGENCY DEPARTMENT.**

**Peter Chessum**<sup>1,2,3</sup>, Benjamin McWalter<sup>1</sup>, Natalie Sandford<sup>2</sup>;  
<sup>1</sup>Walsall Healthcare NHS Trust, Sutton Coldfield, United Kingdom,  
<sup>2</sup>Kings College London, London, United Kingdom, <sup>3</sup>University of Birmingham, Birmingham, United Kingdom

**Correspondence:** [Peter.chessum2@nhs.net](mailto:Peter.chessum2@nhs.net)

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**Introduction:** As demand for emergency care escalates, Emergency Departments (EDs) seek to create capacity by commissioning temporary clinical spaces, such as mobile units attached to infrastructure, or via entire new-build departments. Expanding and modernising the areas in which treatment is delivered aims to improve the quality of care by increasing capacity within the system; however, moving to new spaces presents challenges and opportunities [1]. In-situ simulation (ISS) has been used in the literature to test new builds [2], but often with a theoretical basis that safety

threats can be found and fixed without a full exploration of everyday clinical work, and often lacking a longitudinal view of risks or opportunities that emerge after moving into the new environment. Modern EDs are appreciated as socio-technical systems, where work is completed by teams using specialised tools and equipment, and staff constantly adapt how they work to meet inherently variable demands. Safety II (SFII) is an approach to understanding complexity in healthcare systems that has developed into a coherent set of guiding principles, but it requires further application in emergency care [3].

**Methods:** Ethical approval was not required for this work as it was a service evaluation. A multidisciplinary team developed a mix of clinical and non-clinical multimodal simulations (n=30) delivered in the newly built ED two weeks before move-in. Seventy-seven staff members from multiple cross-boundary professional groups participated in the project. ISS were designed to identify latent safety threats (LSTs),

illuminate practice variability in Everyday Clinical Work (ECW), and understand how staff adapt to manage demands, informing better system learning. After move-in, the team facilitated longitudinal feedback by organising focus groups to understand how staff had adapted to the new environment.

**Results:** Forty-four LSTs were identified for action or mitigation, Table 1-A8. The Simulation Coordination Team (SCT) also redesigned several patient pathways by learning from descriptions of everyday clinical work and then streamlining processes. After moving into the new build, the 4-hour Emergency Access Standard improved by 4.41%, the average time a patient was seen within 60 minutes by a senior decision maker improved by 2.67%, and the average ambulance handover achieved within 30 minutes improved by 6.33%.

**Discussion:** The SCT found that combining ISS with SFII theory promoted a better understanding of ECW, adaptations, and threats to the system before moving to the new build. Engaging multiple stakeholders,

**Table 1-A8.** Description of simulation, Testing, LST(s), and Mitigation/Action

Sim Ref	Simulation	Testing (Process/ Pathway)	LST(s) Identified/ Categories	Mitigation/ Action
1	Patient Journey: Chest Pain	<ul style="list-style-type: none"> <li>Logical flow through ED to:                             <ul style="list-style-type: none"> <li>Assessment area</li> <li>Ward</li> <li>Discharge</li> </ul> </li> <li>Streaming routes</li> <li>Pre-assessment cubicle suitability</li> </ul>	<ol style="list-style-type: none"> <li>The reclining chairs in the pre-assessment/ECG rooms are not fit-for-purpose so can these be static examination couches? Can we consider the same for Triage? (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Appropriate examples sent to project management - purchased and in situ before new build move</li> </ol>
2	Collapse at triage: Cardiac Arrest	<ul style="list-style-type: none"> <li>To assess in triage room and move to resus/cubicle</li> <li>Space and availability of equipment</li> </ul>	<ol style="list-style-type: none"> <li>Why are there two emergency buzzers? (E<sup>n</sup>/T)</li> <li>Will Vocera work throughout the build? (E<sup>n</sup>)</li> <li>Where are the emergency buzzer panels? (E<sup>n</sup>/T)</li> <li>Where are the otoscopes/ ophthalmoscopes going? (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Build/project team state it is new regulations</li> <li>Additional access points for WIFI are now installed and all "black spots" identified and resolved before move</li> <li>Shown to sim team, panels still required programming - completed before move</li> <li>Discussed with clinical team. Fitted in every cubicle on a side wall at the head-end of the wall</li> </ol>
3	Transfer to CT of critically unwell patient: Elderly Abdo Pain	<ul style="list-style-type: none"> <li>Logistics of space</li> <li>Availability of equipment and routes.</li> </ul>	<ol style="list-style-type: none"> <li>Do we get priority for the pod system if others are queued? (E<sup>n</sup>)</li> <li>Where is the alert phone going? Will there be a ringer in resus? (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Pod system has not changed. Project team advised no impact on ED.</li> <li>Will be positioned at the Nurse in Charge (NIC)/ Emergency Physician In Charge/ Progress Chaser Desk. No ringer in resus.</li> </ol>
4	Transfer to theatre of trauma patient.	<ul style="list-style-type: none"> <li>Communication with theatres</li> <li>Distance from New ED</li> </ul>	<ol style="list-style-type: none"> <li>Pathway development conversation (T/P)</li> <li>Do we have any new syringe drivers? (E<sup>n</sup>)</li> <li>Is there telemetry in resus (as you cannot see the patient in Bay 1 from sat at the nurses desk for example)? If so, does it alarm at the desk or just in the bay? (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Direct to theatre pathway.</li> <li>Medical library to implement a process for medical devices ED have a total of 24 pumps. ED now have syringe driver and infusion pump charging stacks in ED for majors and resus.</li> <li>Yes, central monitoring in resus and at NIC staff base and alarms at all telemetry stations.</li> </ol>
5	Collapse on way to Ambulatory Care	<ul style="list-style-type: none"> <li>Time for response to emergency buzzer from different areas</li> <li>Space and logistics</li> </ul>	<ol style="list-style-type: none"> <li>Are we finalised on labelling above doors of areas? (See and Treat for example is not labelled from the Major's side which has caused confusion when moving patients during a number of sims) (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Signage is yet to be complete - once installation has been finished we can complete a walk through - FBC installed - further additions now on order - awaiting install date from TDC</li> </ol>
6	Prepare for transfer to a different hospital	<ul style="list-style-type: none"> <li>Admin logistics (printing/ photocopying)</li> <li>Logistics of ambulance attendance</li> </ul>	<ol style="list-style-type: none"> <li>The doors are very heavy - assuming this is just because they will be automatic? (E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>They are automatic - not turned on for a number of sims as work still ongoing.</li> </ol>
7	Major Haemorrhage: Trauma	<ul style="list-style-type: none"> <li>Maj Haemorrhage protocol</li> <li>Distance from blood bank</li> <li>Time for blood to get to New ED</li> </ul>	<ol style="list-style-type: none"> <li>Can we have clocks and whiteboards in every resus bay? (E<sup>n</sup>/E<sup>n</sup>/P)</li> </ol>	<ol style="list-style-type: none"> <li>Clocks and whiteboards ordered and fitted before move.</li> </ol>
8	Major Trauma: Adult	<ul style="list-style-type: none"> <li>Ambulance pt to resus from ambulance bay</li> <li>Familiarisation of trauma team with New ED</li> <li>Trauma network awareness</li> <li>Location of equipment in New ED</li> </ul>	<ol style="list-style-type: none"> <li>Screens needed for resus (in case we need to split cubicles for major incidents etc.) (E<sup>n</sup>/E<sup>n</sup>)</li> </ol>	<ol style="list-style-type: none"> <li>Additional screens made available to ED before move.</li> </ol>

**Table 1-A8.** Description of simulation, Testing, LST(s), and Mitigation/Action (*Continued*)

Sim Ref	Simulation	Testing (Process/ Pathway)	LST(s) Identified/ Categories	Mitigation/ Action
9	Major Trauma: Paediatric	<ul style="list-style-type: none"> <li>Ambulance patient via ambulance door to resus compared to moving them to Paeds ED</li> <li>Availability of equipment (major trauma kit)</li> <li>Introducing trauma team to new resus.</li> <li>Knowledge of how to manage paedts trauma patient and trauma network</li> <li>Step-up vs. step-down Paeds ED and Resus</li> </ul>	15. Can we have a joint adult and paediatric airway trolley in all resus bays? ( <i>E<sup>o</sup></i> )	15. They are not big enough for both sets of equipment, so will remain separate.
10	Cardiology: ST Elevation Myocardial Infarction	<ul style="list-style-type: none"> <li>Walk in process of how chest pain managed via triage</li> <li>Assessment of pt in space available</li> <li>Availability of equipment (ECG machines etc.)</li> <li>Bring through for ECG in pre-assessment rooms behind triage</li> <li>Transfer to majors vs. resus.</li> <li>Where to get drugs from in majors and resus</li> </ul>	16. Are there drugs in triage? ( <i>E<sup>o</sup></i> ) 17. Is there canulation kit in triage, or just in the post-triage intervention/ECG rooms? ( <i>E<sup>o</sup></i> )	16. Paediatric triage has drug cupboards, we can move the current drug cupboard from triage in the retained estate into one of the triage rooms. New cabinets now ordered - awaiting install date 17. Stock was to be defined by clinical teams. There is cannulation equipment in triage.
11	Aortic Dissection	<ul style="list-style-type: none"> <li>Moving from corridor to resus</li> <li>Arterial line equipment</li> <li>New monitor set-up</li> <li>Use of syringe drivers in new space</li> <li>Transfer bag suitability</li> </ul>	18. Can we have emergency buzzers in the long corridor? ( <i>E<sup>o</sup>/P</i> )	18. Yes - awaiting install date.
12	Cardiology: Bradycardia	<ul style="list-style-type: none"> <li>Level 2/3 care in the space we have</li> <li>Medical management of bradycardia including pacing and drugs</li> </ul>	19. New telemetry monitors will need testing ( <i>E<sup>o</sup>/E<sup>o</sup></i> )	19. Tested and functional
13	ED Operations and Escalation: Trust-wide Tabletop	<ul style="list-style-type: none"> <li>Triage Delay</li> <li>Bed Wait</li> <li>Staffing Crisis (Nursing and Medical)</li> <li>Ambulance Offload Delay</li> <li>Internal Critical vs. Major Incident</li> <li>Full Resus</li> <li>Multiple Cardiac Arrests</li> <li>IT Service Failure</li> <li>Phone/ Bleep Failure</li> <li>POD Failure</li> <li>Mass Strike Action (e.g. 72-hour walk-out)</li> <li>Delays with non-admitted patients/ peaks in activity</li> </ul>	20. ED Operations and Escalation Plan update needed ( <i>P</i> )	20. Update dynamic and being reviewed
14	COPD: Type 2 Respiratory Failure	<ul style="list-style-type: none"> <li>Access to equipment in resus</li> <li>Level 2/3 care</li> <li>Use of NIV in new resus</li> <li>IT and communication infrastructure</li> </ul>	21. Why is there medical air ports in Resus - previous incident meant they were capped-off in old ED. ( <i>E<sup>o</sup>/E<sup>o</sup>/T</i> )	21. Health and Safety team aware, medical air requested at design stage and restricted. Approved by medical advisor committee, they all have different outlets to Oxygen - removable caps attached before move which is aligned to the Risk Assessment.
15	Overdose: Calcium Channel Blocker	<ul style="list-style-type: none"> <li>Use of high dose glucagon/ insulin</li> <li>Do we need "poisons box" in Pharmacy</li> <li>IT and communication infrastructure</li> </ul>	22. Discuss with Pharmacy regarding a box of 30 Glucagon and rotation into live-stock when dates get close ( <i>E<sup>o</sup>/P</i> )	22. Implemented in resus drugs room.
16	Infection Risk: Negative Pressure Room	<ul style="list-style-type: none"> <li>Test negative-pressure room</li> <li>Access from outside by ambulance</li> </ul>	23. The negative pressure room needs to be resus specification. ( <i>E<sup>o</sup>/E<sup>o</sup></i> )	23. Negative pressure room will have full resus specification before handover.
17	Minor Injury: Woundcare Simulation	<ul style="list-style-type: none"> <li>Access to minors cubicles</li> <li>Storage of woundcare equipment</li> <li>Process of senior advice from minors for complex wound</li> </ul>	24. Why is there no main desk for notes in See and Treat? ( <i>E<sup>o</sup></i> ) 25. Are there x-ray screens in S&T? ( <i>E<sup>o</sup>/E<sup>o</sup></i> ) 26. Is there equipment in S&T for Oxygen etc? If not, why are there ports? 27. Door codes need to be more intuitive, or the codes will no doubt be written on the door frames. ( <i>E<sup>o</sup>/T</i> ) 28. S&T cubicles need to have basic analgesia including local anaesthetic and equipment. ( <i>E<sup>o</sup>/E<sup>o</sup>/T/P</i> )	24. There are desktop computers in every cubicle in See and Treat (S&T) 25. Yes, Picture Archiving and Communication System (PACS) screen installed before move. 26. Yes, all cubicles are configured the same. 27. Door codes have been changed to be more intuitive 28. The aim is to have a drugs cupboard in S&T. Equipment trollies in situ before move.

**Table 1-A8.** Description of simulation, Testing, LST(s), and Mitigation/Action (*Continued*)

Sim Ref	Simulation	Testing (Process/ Pathway)	LST(s) Identified/ Categories	Mitigation/ Action
18	Pregnant: Resuscitative Hysterotomy	<ul style="list-style-type: none"> <li>• Access to equipment in resus</li> <li>• Use of multiple teams in new space</li> </ul>	29. Further discussions as per point 8	29. Further discussions as per point 8
19	Cardiac Arrest: Adult	<ul style="list-style-type: none"> <li>• Familiarisation with new environment</li> <li>• Familiarisation with equipment</li> </ul>	30. We need level 3 care trollies in the main department ( <i>E<sup>n</sup></i> ) 31. Do the big glass doors in the main department have any way of becoming opaque ( <i>E<sup>n</sup></i> )	30. Additional trollies purchased and stocked. 31. Yes - there are curtain rails on the inside. Curtains fitted before move.
20	Cardiac Arrest: Paediatric	<ul style="list-style-type: none"> <li>• Familiarisation with new environment</li> <li>• Familiarisation with equipment</li> </ul>	32. New buzzer system has two separated colours (blue and red) need to twist lenses so blue is outermost and more visible for higher-priority emergencies ( <i>E<sup>n</sup>/T</i> )	32. Split removed from every lens - now entire fitting flashes the colour
21	Rapid Tranquillisation: Adult	<ul style="list-style-type: none"> <li>• Availability of drugs</li> <li>• Availability of expert help</li> <li>• Emergency buzzers and Vocera badges</li> <li>• Ease of access to guidelines</li> <li>• Difficult airway drills and support</li> </ul>	33. The ventilators in resus need to be in an intuitive/ergonomic position as ITU would struggle to set it when ventilating due to size of bay ( <i>E<sup>n</sup>/E<sup>n</sup></i> )	33. When bays set up, trolley moved closer to head of cubicle than centre as bars are fixed to wall.
22	Rapid Tranquillisation: Older Adult	<ul style="list-style-type: none"> <li>• Availability of drugs</li> <li>• Availability of expert help</li> <li>• Emergency buzzers and Vocera badges</li> <li>• Ease of access to guidelines</li> <li>• Post-procedural logistics</li> </ul>	34. X-ray waiting area is a potential risk for patients if we are unable to guarantee escorts due to buzzer system in retained estate not linking to new build ( <i>P/E<sup>n</sup></i> )	34. Current buzzer systems ring in retained estate - x-ray will need to call 2222 when ED move. Email sent to radiology and resus team to ensure new process
23	Overdose: Rapid Sequence Induction	<ul style="list-style-type: none"> <li>• Availability of kit</li> <li>• Speciality ease of access</li> <li>• Speed of medication collection</li> </ul>	35. RSI drugs box would be useful ( <i>E<sup>n</sup>/T</i> )	35. Box agreed by Pharmacy and contents decided by ED and ITU teams
24	Hypothermia	<ul style="list-style-type: none"> <li>• Rewarming therapies and availability</li> <li>• Distance for supporting equipment</li> </ul>	36. New warmer required ( <i>E<sup>n</sup></i> )	36. Funding identified and ordered
25	Sedation: Complicated fracture reduction	<ul style="list-style-type: none"> <li>• Availability of drugs</li> <li>• Availability of expert help</li> <li>• Emergency buzzers and Vocera badges</li> <li>• Ease of access to guidelines</li> <li>• Post-procedural logistics</li> </ul>	37. More computers are required for note taking ( <i>E<sup>n</sup>/P</i> )	37. 6 computers installed in cubicles and 8 new computers-on-wheels ordered - feedback from clinicians during workshops that laptop-safe is being used more often
26	Major Haemorrhage: Medical (Gastrointestinal Haemorrhage)	<ul style="list-style-type: none"> <li>• Re-test process after changes made</li> <li>• Speed of blood product availability in new space</li> </ul>	38. Ascites pathway discussed - work towards looking for Same Day Emergency Care space or input ( <i>P</i> )	38. Care Group are discussing - will depend on priorities of the division of Medicine and Long Term Condition
27	Paediatric: Peri-arrest	<ul style="list-style-type: none"> <li>• Timely response of teams</li> <li>• Access to equipment</li> </ul>	39. Moving paediatric patients to resus will split paediatric nurses and takes longer the old build ( <i>E<sup>n</sup>/T/P</i> )	39. Resus bay identified in paediatric emergency department and stocked as resus. Paediatrics will be treated in paed rather than resus when condition and staffing would deem this safer for patients
28	Neonatal: Resuscitation	<ul style="list-style-type: none"> <li>• Existing equipment suitability</li> </ul>	40. Need a new resuscitaire - current one is outdated, not fit-for-purpose or robust ( <i>E<sup>n</sup></i> )	40. Uniformity with new purchases within maternity/neonatal areas - same model of resuscitaire procured.
29	Mental Health: High Risk/ Absconding	<ul style="list-style-type: none"> <li>• Buzzer configuration</li> </ul>	41. New buzzer system - needs labelling correctly ( <i>E<sup>n</sup></i> ) 42. New buzzer system - needs every emergency pull (red and blue) to ring in all areas ( <i>E<sup>n</sup>/P</i> )	41. Programming signed off and tested 42. Programming signed off and tested
30	Major Incident: Multi-Agency Simulation	<ul style="list-style-type: none"> <li>• Test the new build is fit for purpose to manage a mass casualty incident</li> <li>• Test layout and newly formulated major incident plans are fit for purpose</li> <li>• To test flow throughout the new build in a major incident</li> </ul>	43. Major Incident Plan and training need amending in line with feedback ( <i>E<sup>n</sup>/P</i> ) 44. Uniformity of triage systems with statutory ambulance service would be useful ( <i>P</i> )	43. Amended and new training rolled out as mandatory for ED staff 44. Procured and will be used when delivered

Key: Equipment (*E<sup>n</sup>*); Environment (*E<sup>n</sup>*); Teams (*T*); Process (*P*)

from executives to external teams, created learning opportunities and shaped better responses to demands.

**Ethics statement:** Authors confirm that all relevant ethical standards for research conduct and dissemination have been met. The submitting author confirms that relevant ethical approval was granted, if applicable.

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