CENTRAL LINE TRAINING MODELS: LIMITATIONS AND MODIFICATIONS

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Background: Training in simulated environments allows clinicians to practise procedures and make mistakes without risk to patients. It is important training models offer sufficient fidelity, allowing the trainee to face the same difficulties and hazards that they would in clinical practice. This is particularly true of technical skills training using part-task trainers. Current designs of central-venous cannulation simulators may not fully meet this need. Not all training models allow for the guidewire in the Seldinger technique to be over-inserted. This means guidewire loss cannot be demonstrated in many simulators, which undermines recognition of this important complication, one of the preventable and significant hazards of the procedure [1]. Our simulation centre uses Blue Phantom's Gen II Central Line Ultrasound Training Model. This simulator replicates the upper torso and neck, with a right internal jugular vein and carotid artery that can be cannulated. The simulated vessels terminate in clear tubes that run outside of the manikin's torso and contain a reservoir of fluid. Full insertion of the line is blocked due to the diameter of the reservoir tubing being too small to accommodate the J-tip of the guidewire.

Methods: In order to permit over-insertion of the guidewire, the tubing connected to the internal jugular vein has to be replaced with one of a larger diameter, sufficient to allow passage of the guidewire's J-tip. We developed a 3D printed adaptor which allows smooth passage of the wire into the larger-diameter tubing. The connection between the tube and adaptor is then made water-tight with silicone sealant. The modifications were designed using SolidWorks, Dassault Systèmes, and printed using VeroWhitePlus™ on a Object500 Connex1™ by Stratasys. Since the reservoir tubing can now accommodate guidewire retention, a further modification was required to allow for retrieval of the wire at the end of the simulation. We have achieved this by including access to the tubing secured by a screw cap.

Results: With the modifications made (Figure 1), the guidewire can now be over inserted and easily recovered by faculty at the end of the simulation. This is an important modification because it eliminates the artificial feedback trainees would receive in other models on attempting to over-insert their wire.

Conclusion: The trainee cannot now rely on the manikin preventing them from making this potentially serious mistake, so training now more accurately replicates the real-life experience. This allows for a richer training experience and a more valuable post-simulation learning conversation.

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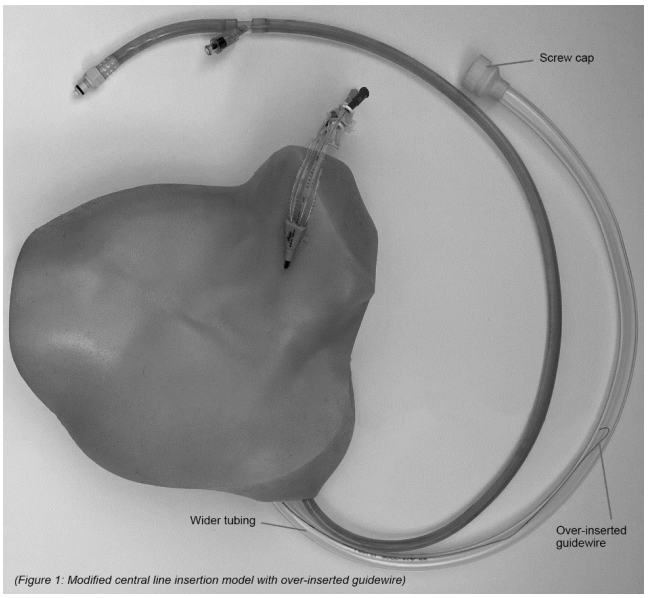

Figure 1: Modified central line insertion model with over-inserted guidewire.

PATIENT AND FAMILY INVOLVEMENT IN DESIGNING AND EVALUATING A SIMULATION PROGRAMME TO COMBAT CHILDHOOD OBESITY

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Background: 14.4% enter school reception obese [1]. The Paediatric Emergency Department (PED) offers opportunities for professionals to identify obesity and provide support to children and young people (CYP). Our PED launched an Obesity Toolkit: a medical education project created to help Make Every Contact Count, and to increase opportunistic diagnosis and sensitive communication about obesity (2). This includes teaching resources including communication scenarios and videos. Staff focus groups identified the main barrier for professionals was fear around communicating about obesity in a sensitive way. We aimed to collaborate with CYP to develop our communication simulation programme within the Toolkit. In addition, we aimed to involve families in the evaluation of the project.

Methods: We developed written patient leaflets, written and filmed communication scenarios incorporating feedback given by focus groups with Youth Empowerment Squad (YES), our local Trust CYP forum. The feedback included preferred language, which was emphasised in the debriefings of simulated sessions. The educational role-play scenario videos, which can be debriefed in teaching sessions, were filmed with a CYP taking on the role of a patient. After the release of the toolkit and accompanying simulation programme, 10 patients diagnosed as overweight or obese were randomly selected 2 to 4 months after attendance, as part of a patient experience survey. This telephone call explored parent opinions about the obesity discussion.

Results: Learning from CYP in YES helped us explore their preferred language, such as focussing on healthy living over the concept of obesity and explaining what is meant by body

mass index (BMI). We included this in our debriefings. Our role-play videos are used in training to give examples of obesity discussions with CYP. These were semi-scripted to allow the CYP to incorporate their own voice and provide their insight into how they or their peers might react. In the patient experience survey, all parents were positive about the approach, rating the conversation on average 7.6/10 for being helpful (10 most helpful). Notable comments from parents included 'the approach was sensitive, they spoke about positive change, not negative'.

Conclusion: Parents talked positively about conversations that they had about obesity with staff trained using our simulation programme designed following CYP collaboration. It is encouraging that these conversations have been useful for CYP and families. Based on this feedback, we will continue to engage CYP and parents. Feedback from CYP is planned. The Obesity Toolkit is made free and Open Access for any interested departments.

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CREATING AN EASY TO CONSTRUCT, LOW-COST ASPIRATION SIMULATOR FOR AIRWAY TRAINING

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Background: Aspiration of gastric contents remains the commonest cause of death during anaesthesia, accounting for 50% of deaths and occurring more frequently than cannot intubate, cannot oxygenate (CICO) events [1]. Despite this, training for CICO is ubiquitous while rehearsal of aspiration management is rare. Soiled airway simulation has been shown to reduce the time to intubation with less volume entering the lungs, a factor known to correlate with the severity of aspiration [2]. Initially developed by Dr DuCanto, high-fidelity vomit simulators have existed since 2014 however cost (£1,595) precludes their widespread use. Low-cost models have since been described, however, the materials are sourced from hardware stores, relatively expensive, require skills to construct, utilise noisy pumps, and some even require electrical safety considerations [3]. We aimed to improve access to aspiration training by designing an aspiration simulator that is easy to construct and low-cost.

Methods: Employing an iterative design process we created an aspiration simulator using materials readily available in the operating theatre. The final model requires an intubatable manikin with an oesophagus, such as the Laerdal Airway Management Trainer™. The oesophagus is intubated distally with a shortened size 9.0 cuffed endotracheal tube (acting as both a conduit and seal), which is then connected to a shortened bladder irrigation set and two 3-litre bags containing simulated regurgitation (made from propofol, water, and green food colouring), elevated and manually pressurised to 300 mmHg (Figure 1, upper left).

Results: The setup silently produces a titratable flow of up to 250 ml per minute, sufficient to flood the oropharynx within 30 seconds. The simulation itself can be set up in under 10 minutes, used several times before requiring refilling, and is easily transported between theatres as a part-task trainer or concealed for a multi-disciplinary simulation (Figure 1, bottom left). All parts are reusable and the total cost equals £9.90 (excluding the manikin, which is undamaged). Our simulator was tested on a cohort of 16 middle-grade anaesthetic trainees and its performance was evaluated using pre and post-course questionnaires (scale 0–10). All successfully intubated the simulator. Average user-rating scores for realism were 8.4/10 while confidence in managing soiled airways improved from 6.2/10 to 8.9/10 after exposure to the simulation.

Conclusion: Soiled airway simulation can be simple and affordable, creating a realistic environment to practise the unique skills necessary to manage this important yet under-rehearsed cause of death during anaesthesia.

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DESIGN OF A FUNCTIONALLY EQUIVALENT MENTAL SIMULATION PROTOCOL FOR LEARNING CARDIAC ARREST SKILLS

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Background: Mental simulation assists learners in repetitive, solitary, deliberate practice. Mental simulation can complement laboratory simulation-based learning and clinical practice in learning skills and increasing self-efficacy [1]. Mental simulation is a quasi-sensory or quasi-perceptual experience without stimuli and overt physical movement. Mental simulation occurs when one imitates actions in an imaged state but does not trigger the action itself [2]. Mental simulation is based on the 'simulation theory of action'. This theory suggests that observing an action, imaging an action, or understanding an action will activate the neural networks involved in the actual execution of that action. While these states differ, there is a partial overlap between covert and overt action [2]. The images produced during mental simulation must be vivid or high-fidelity to activate the said neural networks. Higher fidelity images create greater 'functional equivalence', increasing the likelihood that the imager will learn from their experience [3]. The aim was to create a mental simulation protocol rich in motor and sensory cues that would assist pre-registration nurses