Designing team success - an engineering solution to avoid chest tube equipment chaos using best available evidence, consensus and prototyping.

Robert Hanlon, James French, Jacqueline Fraser, Susan Benjamin, Julius Poon, Paul Atkinson

1. Dalhousie Medicine New Brunswick, Saint John, New Brunswick 2. Department of Emergency Medicine, Dalhousie University, Saint John Regional Hospital, Saint John, New Brunswick 3. NB Trauma Program, Saint John, New Brunswick 4. Division of Thoracic Surgery, Saint John Regional Hospital, Saint John, New Brunswick

Background:
Chest tube insertion is a time and safety critical procedure with a significant complication rate (up to 30%). Industry routinely uses Lean and ergonomic methodology to improve systems. This process improvement study used best evidence review, small group consensus, process mapping and prototyping in order to design a lean and ergonomically mindful equipment solution. By simplifying and reorganising chest tube equipment, we aim to provide users with adequate equipment, reduce equipment waste, and wasted effort locating equipment.

Methods:
The study was conducted between March 2018 and November 2018. An initial list of process steps from the best available evidence was produced. This list was then augmented by multispecialty team consensus (3 Emergency Physicians, 1 Thoracic Surgeon, 1 medical student, 2 EM nurses). Necessary equipment was identified. Next, two prototyping phases were conducted using a task trainer and a realistic interprofessional team (1 EM Physician, 1 ER Nurse, 1 Medical student) to refine the equipment list and packaging. A final equipment storage system was produced and evaluated by an interprofessional team during cadaver training using a survey and Likert scales.

Results:
There were 68 equipment items in the pre-intervention ED chest tube tray. After prototyping 31 items were removed. A total of 37 items were in the post-prototyping model, with ten of them being new. The ten items missing from the original design were found in four different locations in the department. Six physicians and seven RNs participated in cadaver testing and completed an evaluation survey of the new layout. Participants preferred the new storage design (Likert median 5, IQR of 1) over the current storage design (median of 1, IQR of 1).

Discussion: The results suggest that the lean equipment storage is preferred by ED staff compared to the current set-up, may reduce time finding missing equipment, and will reduce waste. Future simulation work will quantitatively understand compliance with safety critical steps, user stress, wasted user time and cost.

• Emergency Physicians and Nurses want LEAN equipment
• 31 items were removed from the chest tube tray
• A user oriented storage system was developed

Contact:
Robert Hanlon
rb439440@dal.ca
@roberthanlon12

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Link to all SJHREM@CAEP 2019 Research

Pack 1! Nurse/Assist:
Open Chest Tube Tray: add scalpels, sutures, gauze, antiseptic, syringe, and needles to sterile field.

Pack 2! Nurse/Assist:
1. Add sterile towels to field
2. Open Chest Tube Package
3. Hold lidocaine bottle for medication draw
4. Set up drainage system
5. Wear sterile gloves to stabilize tube for suturing