

A consensus to determine the ideal critical care transfer bag

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Abstract

Background: Familiarity with environment, processes and equipment reduces the risk inherently associated with critical care transfers. Therefore, the North West London Critical Care Network decided to create a standardised ideal transfer bag and contents to improve patient safety.

Methods: A four-round modified Delphi survey developed a condensed and clinically tested content list. An expert panel then designed an ideal transfer bag based on agreed important principles.

Results: Participants completed two rounds of an electronic survey. Round 3 comprised an expert clinical panel review, while round 4 tested the contents over 50 clinical transfers. The prototype bag's design was adjusted after clinical use and feedback.

Discussion: This project has introduced a standardised critical care transfer bag across our network. A similar technique could be used for other healthcare regions. Alternatively, the above critical care transfer bag could be adopted or adapted for regional use by clinicians.

Keywords

Critical care, patient transfer, patient safety, equipment and supplies, Delphi technique

Background

Critical Care transfers are common and inherently associated with risk. Unfamiliarity with environment, processes and equipment contribute to this risk.^{1–3} Frequent rotation of medical staff undertaking transfers and a lack of standardised equipment, particularly the transfer bag, are exacerbating factors. The North West London Critical Care Network (NWLCCN) has shown that patient safety during critical care transfers can be improved by standardising regional transfer training and education material.⁴ These methods increase clinicians' familiarity with transfer processes and equipment.

A vital piece of transfer equipment is the transfer bag, which contains life-sustaining and supporting equipment. Despite showing that standardisation reduces risk, there continues to be a considerable variation in the contents and designs of transfer bags even within regions and their constituent hospitals. It is not uncommon to find large wheel-based suitcases that create a struggle to manoeuvre into lifts and along corridors. Therefore, NWLCCN embarked upon a project to create the ideal transfer bag design and content list. This article describes the development of this bag and its introduction into the clinical environment.

Methods

Stage 1: Creating the bag contents list

The initial list of transfer contents was all inclusive (Table 1) and generated from the combination of the Intensive Care Society 2011 list of 'Supplementary equipment for use during transport',⁵ North West London Critical Care transfer bags and London HEMS (Helicopter Emergency Medical Service) and RAF CCAST (Critical Care Air Support Team) bags. A modified Delphi Survey with four "rounds" enabled the list to be condensed appropriately.

Round 1 was an electronically mailed spreadsheet of all 146 items separated into categories (Airway, Breathing, Suction, Circulation, Enteral, Drugs, Infection Control, Monitoring and Other). This was

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sent to clinicians within North West London comprising nurses, physicians and paramedics working within different departments (Critical Care, Emergency, Anaesthetics and Ambulance service) with a range of seniority. They were asked to rate items using a 5-point Likert scale ('Very unimportant,' 'Quite unimportant,' 'Neither,' 'Quite important,' 'Very

important') and decide how many of each item would be needed within the final bag. An additional question asked if the clinician had used the item during any previous transfers to prompt consideration of its need in the final ideal bag. A pilot study consisting of 10 individuals was undertaken to determine if completion of the extensive questionnaire was

Please see attached photographs for Airway, ventilation / breathing, Circulation and Suction showing the items included after the first round of analysis.
Would you please confirm using the table below if you agree with the contents of each section?

- If yes then confirm in **Column A**. *please note at this stage we are not agreeing the number of each item*
- If no then annotate in **Column B**
- Add any items in **Column C**
- Please give your rationale for inclusion in **Column D**

	A	B	C	D
Section – see photos	I Agree with contents <i>(please note at this stage we are not agreeing the number of each item)</i>	I Disagree with contents	I want these Additional item/s considered	My Rationale for additional item/s
Airway <i>Photo does not include stethoscope or stylet but they will be included in the bag</i>				
Ventilation / breathing				
Circulation <i>Photo does not include every size of syringe and needle but they are included in the bag</i>				
Suction				



The figure contains four photographs of medical supplies. The top-left photo shows airway equipment including masks and tubes. The top-right photo shows ventilation and breathing equipment like reservoirs and connectors. The bottom-left photo shows circulation supplies such as syringes, needles, and IV bags. The bottom-right photo shows suction equipment including canisters and tubing.

Figure 1. Electronically mailed questionnaire to decide on selected transfer bag contents.

Table 2. Round 1: summary of responses.

92 replies		Type of clinician:	
Department respondent from:			
ICU	67	Nurse	64
Outreach	3	Resuscitation officer	6
Resuscitation	6	Doctor	20
Emergency	14	Paramedic	2
Ambulance service	2		
Additional items			
Airway:		Requested by:	
• Emergency needle/ surgical airway set			3
• Tracheostomy tubes or 'passport box'			3
• Choice of 'Airtraq' laryngoscopes			1
Breathing:			
• Chest drain kit			2
Suction			
• Suction liners			1
• 50 ml bladder syringe with tubing for suctioning			1
NG/Enteral			
• Lubricant			1
Drugs			
• Ketamine			4
• Suxamethonium			1
• Rocuronium			2
• 10% dextrose			1
• Opiates			1
• Antibiotic			1
• Water ampoule			1
Infection control			
• Incontinence pads			2
• Sharps bin			1
Monitoring			
• Defibrillator			2
• Head torches			1

Table 3. Round 2: summary of responses.

Airway	Breathing	Circulation	Suction
57 (100%) agreed with contents shown from round two	51 (89%) agreed with contents shown from round two	55 (96%) agreed with contents shown from round two	56 (98%) agreed with contents shown from round two
Additional items:	Comments:	Additional items:	
-More ETT sizes	-'Less catheters than shown in photo'	- Arterial line	
-Syringe for cuff		- Sterile set	
-Igel not LMA (3 respondents)			

achievable in a reasonable length of time and if adjustments were needed.

Round 2 was an electronically mailed questionnaire comprising photographs of the items (Figure 1), which were deemed 'Very important' or 'Quite important' by

at least 80% of respondents from round one. This was simple and quick (less than 5 min) to complete and questioned whether the respondent agreed with the items or if additional items were needed and if so, what the rationale was.

Table 4. The finalised contents list.

<p>Advanced Airway pocket</p> <ol style="list-style-type: none"> 1. 1 × ET tube 6 2. 1 × ET tube 7 3. 1 × ET tube 8 4. 1 × ET tube 9 5. 2 × Laryngoscope Handles + bulbs + batteries 6. 1 × Laryngoscope Blades 3 7. 1 × Laryngoscope Blades 4 8. 2 × Endotracheal ties 9. 1 × Magill Forceps 10. 1 × Tape for securing ET 11. 3 × Lubricating gels 12. 1 × Stylet 13. 1 × Gum elastic bougie 14. 1 × Tracheal dilator 15. 1 × Scalpel size 22 16. 1 × 10 ml syringe 17. 1 × Torch 18. 2 × Face masks 19. 1 × ETCO₂ indicator 	<p>Breathing pocket</p> <ol style="list-style-type: none"> 1. 1 × I-gel size 3 2. 1 × I-gel size 4 3. 1 × I-gel size 5 4. 1 × Airway HME filter 5. 1 × Catheter mount 6. 1 × Waters circuit 7. 1 × Sterile scissors 8. 1 × Anaesthetic mask size 4 green 9. 1 × Anaesthetic mask size 5 orange 10. 1 × Stethoscope 11. 1 × Wave form capnograph <p>Suction pocket</p> <ol style="list-style-type: none"> 1. 2 × Yankauer suckers 2. 2 × Suction catheters (10F) 3. 2 × Suction catheters (12F) 4. 2 × Suction catheters (14F) 5. 2 × Suction tubing 	<p>Circulation pocket</p> <ol style="list-style-type: none"> 1. 2 × IV cannula size 14G 2. 2 × IV cannula size 16G 3. 2 × IV cannula size 18G 4. 2 × IV cannula size 20G 5. 2 × IV cannula size 22G 6. 10 × Pairs of non sterile gloves 7. 5 × Luer lock syringes 20 ml 8. 4 × Luer lock syringes 50 ml 9. 3 × Chloraprep skin wipes 10. 10 × Alcohol wipes 11. 2 × Blood/colloid fluid giving sets (gravity) 12. 5 × Infusion device giving sets 13. 5 × Infusion device extension sets 14. 5 × 3-way taps (or equivalent) 15. 10 × Obturators (red and/or white bungs) 16. 1 × Micropore tape 17. 4 × Gauze 18. 5 × Cannula dressings 19. 12 × ECG electrodes 20. 1 × Trauma shear scissors 21. 10 × Labels 22. 10 × Sodium Chloride ampoules (flush)
<p>Self-ventilating pocket</p> <ol style="list-style-type: none"> 1. 1 × Guedel airways size 2 2. 1 × Guedel airways size 3 3. 1 × Guedel airways size 4 4. 1 × Nasopharyngeal airways 6 5. 1 × Nasopharyngeal airways 7 6. 1 × Oxygen Mask- non rebreathe size 4 7. 1 × Oxygen Mask- non rebreathe size 5 8. 2 × Oxygen tubing 	<p>External pocket</p> <ol style="list-style-type: none"> 1. 1 × Self-inflating bag and mask with oxygen reservoir and tubing (BVM) <p>Inside pouch on side of bag</p> <ol style="list-style-type: none"> 1. 2 × Clinical waste bags 2. 1 × Sharps box (to be sourced locally) 3. 1 × Hand-held portable suction 4. 3 × IV Fluids (crystalloid) 500 ml 5. 1 × Pressure bag 	<p>Interventional circulation</p> <ol style="list-style-type: none"> 1. 1 × EZ-IO Intraosseous Device 2. 3 × EZ-IO Needles 3. 5 × Needles Green 4. 5 × Needles Blue 5. 5 × Needles white 6. 5 × Drawing up needles 7. 2 × Tourniquets

Round 3 consisted of an expert panel of 22 clinicians from the NWLCCN Transfer faculty who met face-to-face to discuss the content list and review the numbers of each item required.

Round 4 involved the clinical use of a transfer bag packed with the agreed items during 50 intra-hospital transfers in three North West London hospitals. A further 105 clinicians reviewed the contents over three NWLCCN transfer training courses. Feedback was obtained during both processes.

Stage 2: Creating the bag design

The process of designing the ideal critical care transfer bag was initiated by reviewing five transfer bags in current use across London. The same expert panel of 22 NWLCCN clinicians met to discuss the advantages and disadvantages of each. The key principles and features to be included were outlined and agreed, including the addition of a 'Patient Pocket' which allowed clinicians the flexibility to add bespoke items for that specific patient transfer.

Having discussed the project with several bag designers, one design company, OpenhouseTM, was approached with the agreed principles and features required for the ideal transfer bag. A schematic diagram was drawn up for review and discussion. The filled control transfer bag provided information about the weight and dimensions of the equipment items.

Feedback about the bag design was collected from the Annual NWLCCN Education Event where the packed prototype bag was presented to the audience with an explanation of the process leading up to it.⁶ Clinicians were given an opportunity during the day to handle the bag and manoeuvre it on and off an ambulance. Afterwards, the prototype bag was taken to all the 19 hospitals in the NWLCCN and to the Emergency, Critical care, High Dependency, Outreach and Anaesthetic departments for further comments and feedback.

Once the bag design had been adjusted from the collated feedback, a further quality assessment was made in the form of 'time to check' tests. During

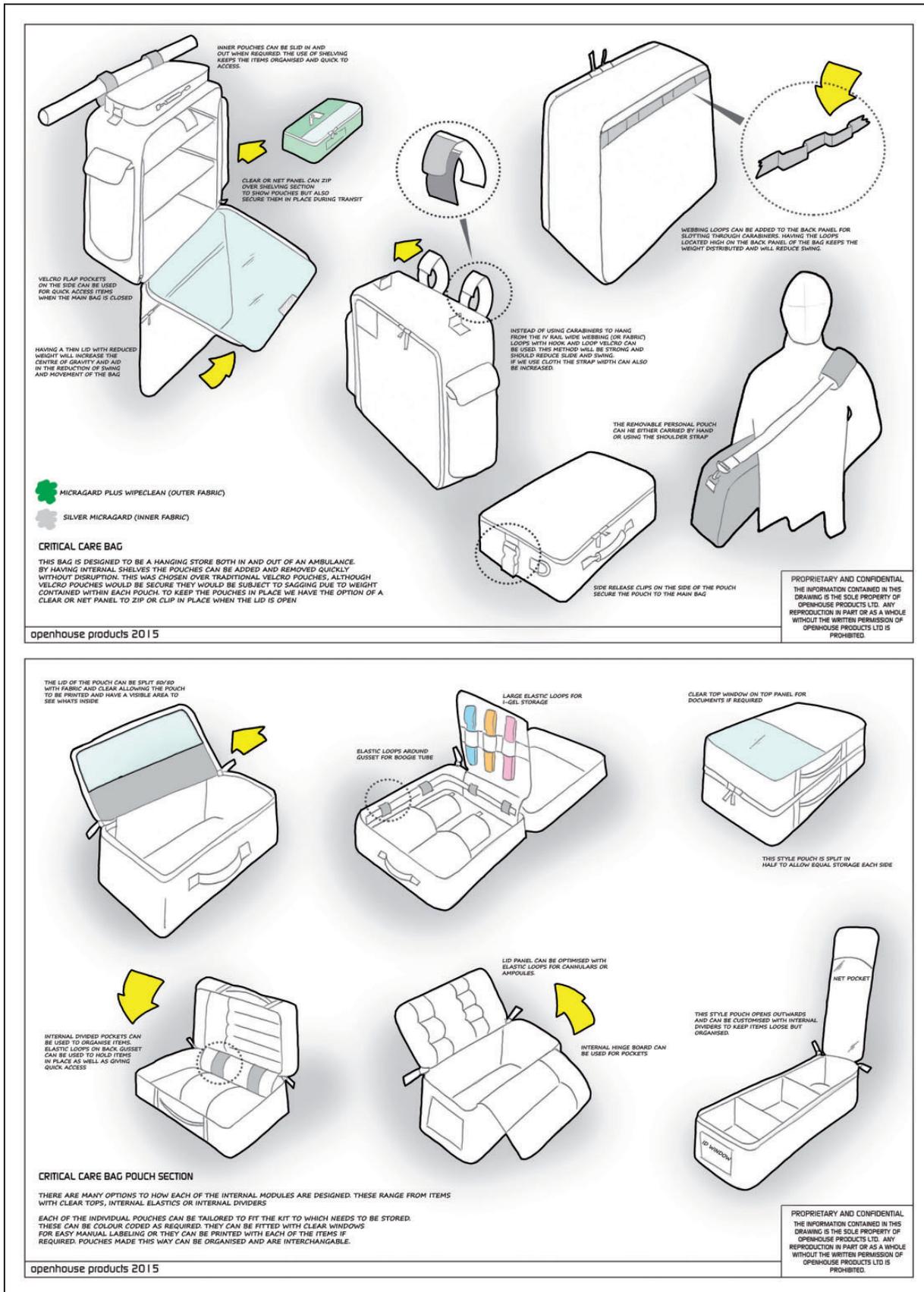


Figure 2. Initial schematic diagram of the transfer bag.® This design is copywritten.

Table 5. Key principles and features as outlined by NWLCCN transfer and retrieval faculty.

<p>Principles</p> <ul style="list-style-type: none"> • Intra or inter hospital transfers would use the same core basic bag • Drugs module would be separate due to CQC (Care Quality Commission) demands regarding storage of drugs, fridge requirement and expiry date management • Waveform capnography would need to be locally provided and this would vary site to site • Designed to be secured on either the bed or trolley depending on the type of transfer • To reduce variation all Trusts in NWLCCN would use the same kit • Patient transfer bag rather than a stabilisation or pre-hospital bag • Adult transfers only <p>Features</p> <ul style="list-style-type: none"> • Able to be secured on bed, trolley and ambulance • Accessibility of contents when hanging • A 'Patient Pocket' would be designed on the outside of the bag, this would be made of clear wipeable material for housing patient specific equipment or consumables e.g. Tracheostomies, chest drains, extra syringes of sedatives or vasopressors for that specific patient transfer • Ability to check 'at a glance' to reduce staff checking time • Filled weight less than 13 kilograms • Able to be carried as a back pack for teams returning after patient transfer completed

Table 6. Modifications following NWLCCN annual event and feedback from pilot sites.

<p>External</p> <ul style="list-style-type: none"> • Bag Valve Mask pocket needs to have picture of BVM in silver reflective pattern and the letters 'BVM' • Make the BVM pocket bigger (same footprint as main bag) • Add the word 'patient' to top of bag therefore: 'Patient Transfer Bag' • Add card holder to identify where the bag originates (HDU ICU AE, etc.) on the top of the bag • Backpack straps need more padding – secured at one end only so when carried like a backpack, patient pocket is uppermost • Straps for securing on the trolley, bed, stack, etc. need to be more robust with an anchor around the whole bag. They also need to tighten and lock into place. The current configuration is the wrong way around • More reflective flashes for teams out at night by repeating patient transfer bag in portrait. This will also assist with orientation of the backpack position • Seams on the outside appeared curled over? • Straps need to be tidier <p>Internal</p> <ul style="list-style-type: none"> • Addition of something to improve the rigidity of the insert sleeves. Allowing for better visibility in the bag and also to assist with repacking the bag • Card holders for checklist that do not cover or block out the kit • Circulation pouch needs attention – make entire pocket from red material, add wording to the outer cover indicating that there are items to check inside • Addition of a documentation wallet to the inside of the main bag lid. Needs to be securable and orientated in such a way that when in use documents remain in • Move the fluids for better weight distribution
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several transfer training courses, candidates were timed against each other, one checking an original transfer bag and the other checking the new NWLCCN prototype, to determine which was fastest and easiest.

Results

Results –Stage 1

The pilot study revealed that the spreadsheet lines were quite hard to follow due to the extensive number of items. Alternate line shading was used to

make the form easier to read. Completion took 30 min, which was considered acceptable.

Round 1 (spreadsheet) was sent to 125 participants and 92 replies (Table 2) were received. Repeated reminders were sent electronically and communicated personally in order to maximise return rates. The section on importance of items was completed well, although some of the comments showed there was confusion if an item was in two categories. There was a poor response to the questions asking how many items were required and whether clinicians had used items during previous transfers. We re-evaluated the usefulness of the last of these questions,

as an item such as an endotracheal tube is not necessarily de-valued because it is rarely used.

Round 2 (photographic) was sent to 137 participants and a total of 57 replies were received. The increase in participant number from the previous round was due to additional clinicians from the Royal Air Force and outside North West London who expressed an interest in the project. The vast majority agreed with photographed items (Table 3): Airway 100% agreed, Breathing 89%, Circulation 96% and Suction 98%.

Round 3 (expert panel) reviewed the results and refined the content list. At this stage, there was also a 'common sense check' regarding the final items, for example, moving a 10 ml syringe to the airway section for cuff inflation during intubation. Unique bags were then filled with the finalised contents list (Table 4). These were different from any transfer bags in clinical use to distinguish them for the study. The layout was compromised as the contents did not fit perfectly into the designated sections but at this stage only the contents were being tested. Four bags were packed, three for clinical use and a fourth as a control to be held at the network office and taken to training events. Any practical changes were made to all four bags simultaneously.

Round 4 (clinical transfers) tested the contents during 50 transfers across three North West London Hospitals. Feedback received was very positive, particularly in regard to the reduced weight with the condensed kit. Over a 10-week period, very little kit was actually used which demonstrated the feasibility of equipment reduction. The outreach team's broader use for the bag (patient stabilisation), which was not part of the bag's remit, meant that the lack of arterial lines and transducer set was highlighted – a 'grab bag' is in development for these teams. Specialised services, for example, Extra-corporeal Membrane Oxygenation (ECMO) acknowledged that they would need to add to the standardised transfer bag.

Results – Stage 2

The initial schematic diagram of the bag is shown in Figure 2. This was the result of the key features and principles (Table 5) that were decided on by the panel of NWLCCN clinicians in June 2014. Several further adaptations were made after the prototype bag. Initial adjustments were made after comments (Table 6) were received from the majority of the 89 attendees at the annual NWLCCN event in December 2015. Further modifications were needed after the bags were tried and tested on various trolleys and beds within different hospitals across North West London and on London Ambulances (Figures 3 to 7).

The ability to check the bag 'at a glance' due to the clear panels or 'open book' design of the pockets drastically reduced the time to check compared

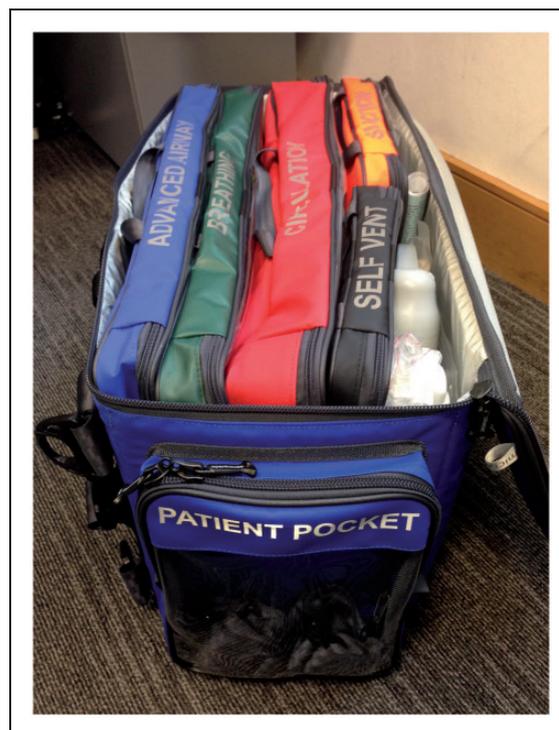


Figure 3. The critical care transfer bag showing the insert sleeves and clear patient pocket.



Figure 4. The 'open book' design and clear panels enabling quick retrieval and checking of equipment.



Figure 5. The transfer bag securely attached to a hospital bed.



Figure 6. The bag attached to an Emergency or Theatre patient trolley with easily accessible insert sleeves.

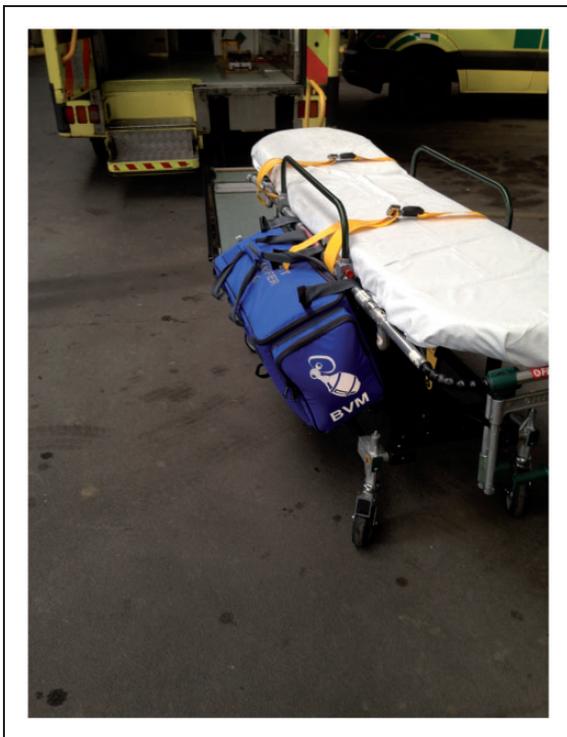


Figure 7. The transfer bag attached to an ambulance patient trolley.

to the conventional critical transfer bags in use currently. The results from the trials timing staff checking the contents of transfer bags revealed an average time of less than 5 min for the NWLCCN

prototype versus a minimum of 20 min for the current bags in use.

Discussion

The original aim of this project was to create a standardised 'ideal' critical care transfer bag with a condensed list of contents to reduce the problem of unfamiliarity with equipment that has been shown to increase the risk associated with critical care transfers. The modified Delphi method used has enabled a large group and a wide variety of clinicians to be involved in this process. The NWLCCN Transfer Bag and its contents have been 'road tested' in the clinical environment in multiple settings by large numbers of personnel to enable further modifications to make sure it is as ideal as possible. The NWLCCN Network is now applying the same methodology to paediatric and ECMO transfer bags.

This critical care transfer bag provides a standardised solution for our critical care network. A similar technique could be used to design a transfer bag for other regions. Alternatively, readers are welcome to adapt or adopt the above critical care transfer bag.

Declaration of Conflicting Interests

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