

Inventory Control for Supplies in Emergency Department

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Introduction

Emergency departments (EDs) use numerous supplies to deliver patient care. These supplies are kept in storage locations and in patient rooms. The right placement, quantity, and standardization of supplies are critical to both the safe patient care and the costs faced by EDs. Table 1 lists some of the supply-related problems recognized in the ED of Rex hospital in Raleigh, NC. The specific aim of this study was to address the inefficiencies occurring in patient rooms by using lean principles. We hypothesize that changes made will allow for higher patient and staff satisfaction at a lower cost.

Methods

A team of industrial engineers used the following interventions:

- Determined the basic flow of supplies (Figure 1)
- Investigated the causes of various problems through observations, conversations and data analysis
- Organized a one-day 5S event in a patient room with a team of a nurse, technician, materials coordinator, team leader, two doctors, and a manager [1]
- Piloted the changes for two weeks using feedback form placed near the nurse's workstation, where every MD, nurse or technician working in the room during the pilot period had the opportunity to provide their comments
- Made further improvements based on the feedback from staff as shown in Table 2
- Documented and communicated all changes with explained reasoning (Table 2)
- Utilized lean philosophy and the "Four Rules in Use" [2-3]

Results

Figure 2 shows changes made in the room. As can be seen, some of the initially implemented changes (e.g. moving the supply cart or removing the white board) were revised through testing and the original setup was brought back. These changes, however, triggered a discussion of how certain items are used which allowed for new improvements (MD supplies stored at the point of use or a new, more friendly and practical white board design and standard patient communication expectations).

Forty-nine percent reduction in inventory (dollars) along with better organization of items released considerable amount of space in the storage cart (Table 3). The restructuring of the room layout enabled both the doctor and the nurse to work simultaneously by standing on either

side of the patient. Although not yet tested, it is believed that standardizing placement and amount of supplies across all patient rooms will help with more effective restocking and decrease the search time.

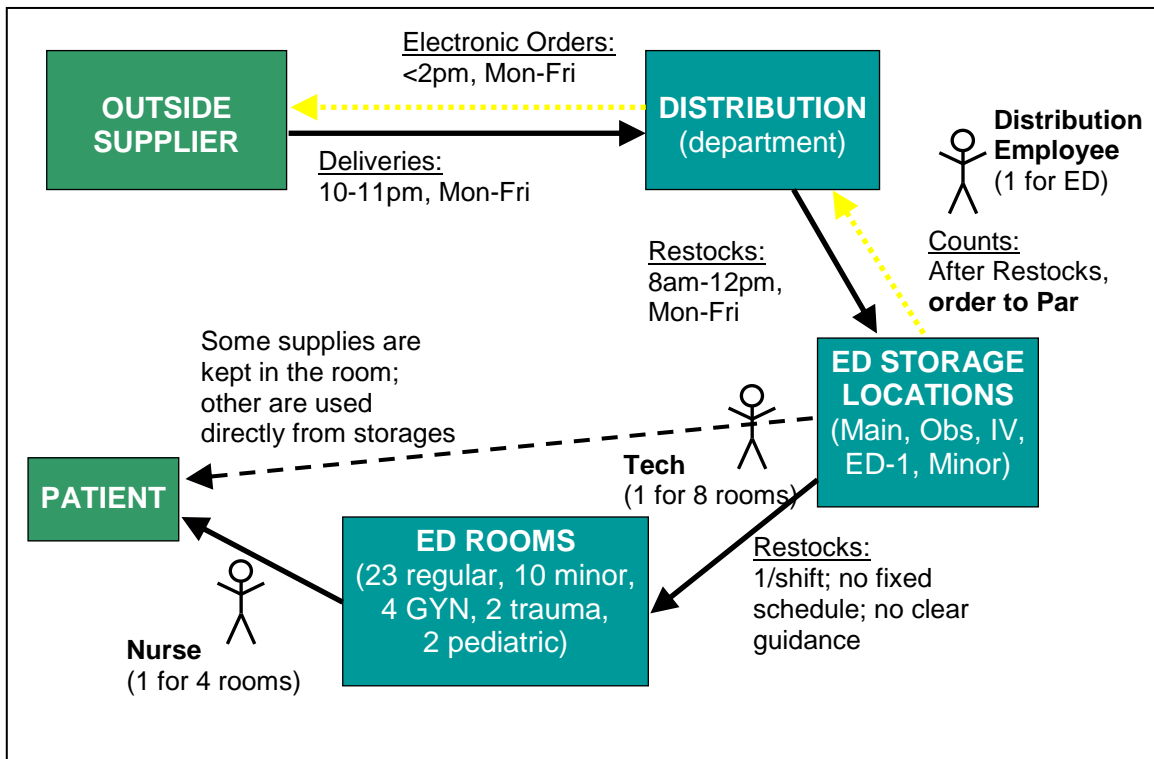
Discussion

Integration of ideas from both the medical staff and industrial engineers can help achieve success in improvement efforts. Visual controls (e.g. labels) play a vital role in aiding restocking activities and consequently reducing inventory levels. The feedback form provides a standard and expected means of communicating changes to staff, and allows gathering ideas from the users, thus helping with continuous improvement. In general, the study supports the necessity for testing of new solutions and confirms the capability of lean in making quick improvements, such as fifty percent reduction in inventory.

- [1] Morrissette, M. (2009) Time-Release Fix: 5S is the little big secret for improving health care. *Industrial Engineer*, 41(8), 34-38.
- [2] Spear, S.J. and Bowen, H.K. (1999) Decoding the DNA of the Toyota production system. *Harvard Business Review*, 77 (5), 97- 106.
- [3] Spear, S.J. (2009) *Chasing the Rabbit*. McGraw-Hill

Table 1 - Some of the supply-related problems in Rex ED

Problem description	Patient Rooms	Storage Rooms
No consistent ordering mechanism	-	✓
No standard procedures for restocking	✓	-
Labels missing for many items	✓	✓
Labels not meaningful	✓	✓
Supplies stored in various places within a room	✓	✓
Mixed items within a bin/basket/cup	✓	✓
Dirty bins and shelves	✓	✓
Little standardization of supplies organization	✓	✓
Difficulties with rotating stock (many open boxes of the same item, etc.)	-	✓
High par levels for many items (bins overflowing/space problems)	✓	✓
Excessive search time	✓	✓



* times in this diagram are only approximations

Figure 1 - Schematic view of the supply flow

Table 2 - Feedback form after the 5S event in the examining room

#	Change	Comments	Response
1	Cart with supplies moved to the left side of the room	<p>The cart on the left side takes away room for families to sit. The area under the monitor is a dead space where no one can sit anyway. Nurses now have to go to one side of the room to put items down for IV start etc. then to other side for printing cardiac strips. Instead, move otoscope to other side of the room.</p> <p>-----</p> <p>Move supply cart under the monitor</p> <p>-----</p> <p>Lets make use of the dead space in the corner under the monitor</p> <p>-----</p> <p>MDs evaluate patients on that side. Cart needs to be placed on the right side of the room; you end up getting in the way if everyone is on the same side; <i>Maybe something on both sides that would have MD supplies and everything else on the other</i></p>	<p><u>Cart</u>: Moving the supply cart to the right and preparing a separate storage location (bin/basket) with supplies for MDs to keep on the left side will be trialed. This idea will be followed up with input from doctors and then with physical changes.</p> <p><u>Otoscope</u> has to remain on the patient's right side as MDs use it more often than nurses.</p> <p><u>Monitor</u> can be located on the other side in a different room, so it is true that there is a dead space underneath, but it should not be a main reason for putting the cart there. However, effort will be made to have needed supplies closer to the point of use.</p>
2	Blood pressure cuffs, Electrodes, and oximeters (for adults) put in a bin below the monitor	Move monitor supply box on wall out a bit	Will be addressed with comment #1
3	Suction equipment and supplies (suction tubing, yankauers, non-rebreathers, nasal cannulas) put on the right side of the panel on the back wall of the room	Move to left side – most people put NG Tube in from patient's right side	Not all equipment can be on the same side, as it will cause overcrowding. Also, addressing comment #1 will require MDs' supplies to be put on the left side of the behind-the-bed board
4	All pediatric supplies stored on the left of the top drawer in the cart	Peds Airway is the #1 resuscitation reason in children. Why is Adult airway more important than peds? Peds Airway supplies should be at head of the bed	Airway is indeed important, both for adults and for children. Pediatric supplies, however, are rarely used in a regular ED room, while the adult supplies are used on the daily basis.
5	Labels used to indicate where items are kept and in which quantities (for standardizing stocking activities)	<p>That is helpful, we often overstocked</p> <p>-----</p> <p>Excellent Idea</p> <p>-----</p> <p>Tacky</p>	Labels indicate the location and par level of each item. This should help with search time and definitely with restocking the room.
6	Orange cards used to indicate items that need immediate restocking (clear bin for cards placed on the wall outside of the room, next to a computer station)	Orange cards in basket above bed will get lost if loose	The reason to use cards is to communicate with a visual signal seen from the outside of the room when the critical items need to be restocked. The cards might be taken out if not able to serve their role.

Table 2 (continued) - Feedback form after the 5S event in the examining room

#	Change	Comments	Response
7	Ambu bags hung on the left wall (end of the room)	<p>Love this idea (Ambu bags on the left wall), however may be cumbersome to get to if you are on the other side of the bed.</p> <p>Bad idea – family may be on that side. Ambu bags should always be at head of bed where they can be accessed. I like the hooks and the labels – Can easily see when it is not there</p> <p>Love this idea</p> <p>Oxygen on opposite side to Ambu bags (times two)</p> <p>Easy to get to!</p>	<p>Ambu bags hanging from the light are constantly in a way; the wall is believed to be easy enough to get to (room 3 does not always have Ambu bags right next to the bed)</p> <p><u>Oxygen</u> should be on both sides of the bed: this will be investigated and followed-up</p>
8	Board displaying the name of physician and nurse removed; Hospital poster placed on the wall instead	<p>Having patient and family familiar with names is important</p> <p>Liked name board better</p> <p>Lets not put heart attack sign in room...</p>	<p>The board will be put back on the wall with the purpose of communicating with patients. This will include nurse's name and actions taken on the patient (e.g. lab, X-ray, CT, Admission...)</p>
9	Trash can added to the left side of the room	Thank you!	<p>The trash can was added to make it accessible when using supplies so that the packaging and anything else could be easily thrown away. This requires trash cans to stay in their designated areas (location will be indicated with a tape)</p>
10	Par levels decreased for several items	Where are the urine cups?	<p>Urine cups should be stocked in the cart (Par of 2); Also, the cups should be available in the patient's restroom (if not found in either place – the problem is with restocking these locations)</p>
11	Par levels decreased for several items	<p>Par levels too low on some items – constantly restocking when you don't have time and have high number of patients</p> <p>Increase par levels</p> <p>Nasal cannulas need higher par level (3 per shift is not usually feasible)</p> <p>More diapers, socks, urinals!</p>	<p>A checklist for room restocking will be placed in the room; Correctly restocking the room (to the assigned par) and using the checklist will allow evaluating the par levels</p> <p><u>Nasal cannulas</u> par level will be increased to 5</p>

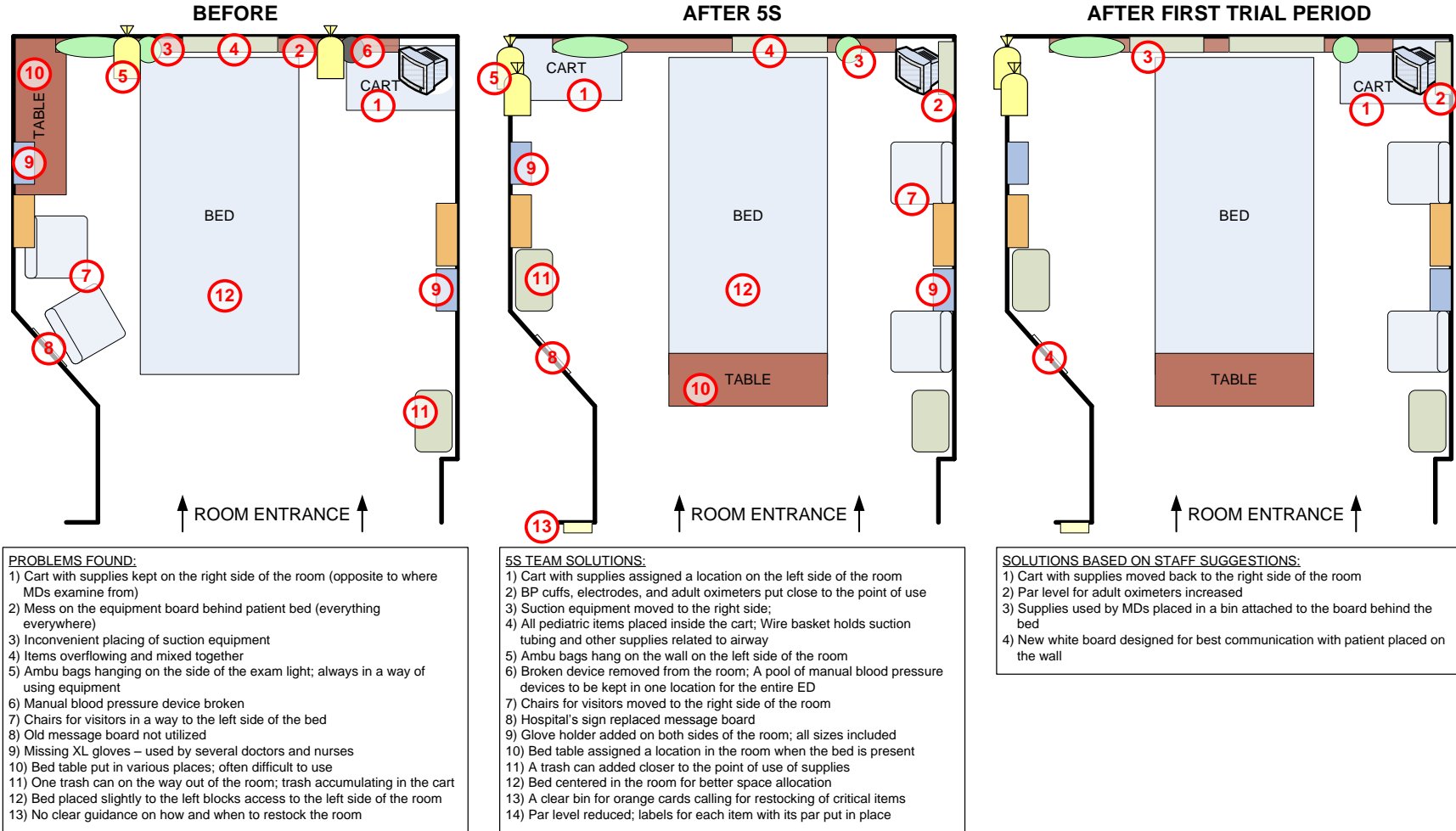


Figure 2 - Schematic layout of the room before and after the 5S event

Table 3 - Cost and space savings from inventory adjustments (after first trial period)

Catalog Description	UM	Qty Found	New Par level	Location Stocked	Amount Found	Amount Stocked	Difference
OXIMETER ADULT (REMFG.)	EA	19	5	new bin	\$178.41	\$46.95	-\$131.46*
KIT CATH FEMALE W/GLOVE	EA	9	3	middle drawer	\$14.40	\$4.80	-\$9.60*
CUFF BP 2-TUBE ADULT LG	EA	3	2	new bin	\$10.61	\$7.07	-\$3.54*
COMFORT BATH DEO 3 CLOTHS	EA	5	2	middle drawer	\$4.30	\$1.72	-\$2.58*
CANNULA PED	EA	4	2	top drawer	\$3.77	\$1.89	-\$1.89*
MASK NON REBREATHING ADULT	EA	5	3	wire basket	\$3.91	\$2.34	-\$1.56*
MASK NON REBREATHING PEDI	EA	2	1	top drawer	\$3.01	\$1.51	-\$1.51*
SPONGE 8 PLY 4X4 IN	EA	4	2	top drawer	\$1.78	\$0.89	-\$0.89*
GLOVE 6 1/2 LATEX SURGICAL	EA	5	2	top drawer	\$1.40	\$0.56	-\$0.84*
UNDERPAD (CHUX) 17X24	EA	18	10	middle drawer	\$1.44	\$0.80	-\$0.64*
KY JELLY 5 GR (PACKET)	EA	28	20	MD bin	\$2.10	\$1.50	-\$0.60*
CUP SPECI 4OZ STERILE	EA	6	2	middle drawer	\$0.90	\$0.30	-\$0.60*
CANNULA NASAL OXYGEN	EA	6	5	wire basket	\$2.69	\$2.24	-\$0.45*
TISSUE FACIAL	EA	4	2	top drawer	\$0.74	\$0.37	-\$0.37*
GLOVE 8 LATEX SURGICAL	EA	3	2	top drawer	\$0.84	\$0.56	-\$0.28*
BLADE TONGUE STERILE 6 IN	EA	12	10	MD bin	\$0.43	\$0.36	-\$0.07*
APPLICATOR 6 IN STERILE	EA	12	10	MD bin	\$0.36	\$0.30	-\$0.06*
BASIN WASH 8QT MAUVE	EA	5	5	bottom cart	\$2.00	\$2.00	\$0.00
BEDPAN STACKABLE MAUVE	EA	2	2	bottom cart	\$1.28	\$1.28	\$0.00
URINAL MALE DISPOSABLE	EA	2	2	middle drawer	\$0.56	\$0.56	\$0.00
BASIN EMESIS 9 IN MAUVE	EA	6	6	middle drawer	\$0.48	\$0.48	\$0.00
SLIPPER ADULT XXLG BLUE	EA	2	2	middle drawer	\$1.48	\$1.48	\$0.00
BRIEF LARGE BLUE (DIAPER)	EA	2	2	middle drawer	?	?	?
TRAY FOLEY CATHETER 16FR LATEX	EA	2	2	middle drawer	\$10.70	\$10.70	\$0.00
COMFORT BATH DEO 8 CLOTHS	EA	2	2	middle drawer	\$2.45	\$2.45	\$0.00
ELECTRODE ECG FOAM BAG/50	EA	24	24	new bin	\$2.58	\$2.58	\$0.00
ELECTRODE ECG PED FOAM	EA	18	18	top drawer	\$2.20	\$2.20	\$0.00
GLOVE 7.5 ESTEEM SMT	EA	2	2	top drawer	\$3.64	\$3.64	\$0.00
PREP ALCOHOL	EA	63	63	top drawer	\$0.36	\$0.36	\$0.00
CULTURETTE II DUAL SWAB	EA	5	5	MD bin	\$1.85	\$1.85	\$0.00
TAPE DURAPORE 1 IN (SILK)	EA	1	1	top drawer	\$0.50	\$0.50	\$0.00
TAPE TRANSPORE 1 IN	EA	1	1	top drawer	\$0.65	\$0.65	\$0.00
GLOVE 8 1/2 LATEX SURGICAL	EA	2	2	top drawer	\$0.56	\$0.56	\$0.00
GLOVE 7 LATEX SURGICAL	EA	2	2	top drawer	\$0.56	\$0.56	\$0.00
GLOVE 6 LATEX SURGICAL	EA	2	2	top drawer	\$0.56	\$0.56	\$0.00
TAPE CAST 2 IN	EA	1	1	top drawer	\$2.34	\$2.34	\$0.00
HEMA PROMPT (HEMAOCCULT)	EA	16	10	MD bin	?	?	?
PEDIATRIC BP CUFF	EA	1	1	top drawer	\$3.05	\$3.05	\$0.00
TUBING SUCTION 5MM X 6FT	EA	2	2	wire basket	\$0.80	\$0.80	\$0.00
SUCTION YANKAUER	EA	2	2	wire basket	\$0.82	\$0.82	\$0.00
BAG PATIENT BELONGINGS	EA	3	6	top drawer	\$0.46	\$0.92	\$0.46
CUFF BP 2-TUBE SM ADULT	EA	1	2	new bin	\$3.22	\$6.44	\$3.22
CUFF BP 2-TUBE ADULT LONG	EA	1	2	new bin	\$3.54	\$7.07	\$3.54
OXIMETER NEONATAL (REMFG.)	EA	0	2	top drawer	\$0.00	\$21.63	\$21.63
OXIMETER PED	EA	2	1	removed	\$18.00	\$9.00	-\$9.00
CUFF BP 2-TUBE NAVY/WHITE ADULT	EA	5	0	removed	\$16.90	\$0.00	-\$16.90*
CULTURETTE MINI-TIP	EA	1	0	removed	\$1.02	\$0.00	-\$1.02

* - space improvement

TOTAL: \$313.64 \$158.63 -\$155.00

Percentage difference: -49.42%