Abstract:

The outcome of ICU patients is directly related to the clinical nursing attention they receive during the severe illness. So to achieve that we designed a unique portable cart able to be stocked with commonly used patient care equipments. We find that this new cart system can significantly increase the clinical time by the nurse with each assigned patient which results significant improved outcome.

Introduction:

The outcome of patients admitted in ICU is closely related to the nursing attention they receive during the severe illness. There are a number of obstacles to a Intensive care nurse tasked to provide patient care. Obstacles identified include delay in getting medications, stocking issues in patient rooms, insufficient workspace for completing paperwork, seeking for supplies or patients' charts and misplaced equipment. [1] There are negative impacts of these obstacles on patient safety and quality of healthcare delivered as perceived by the nurses.[2] Therefore, optimizing nurse ergonomics should results in more clinical time, short response time and fewer errors and complications.

Objectives:

To determine if the introduction of a bedside cart system will maximize the clinical time spent by nurses with their respective patients, save time to completion of tasks and result in a better transfer of care. Further to assess subjective comfort/ease in the nurses at baseline and after 6 months of implementation.

Methods and Materials:

We designed a unique portable bedside cart able to be stocked with commonly used patient care equipment. Preliminary stages of design had to figure in the designated spaces and holders for drugs, fluids, consumables, gloves, hand hygiene and patient related charts. Fig 1. Ergonomic designing required calculating the average height of the nursing staff, depth of the cabinets and locations of the drawers. Transportation and maneuverability was addresses with designing in of large wheel. Safety and regulatory concerns were solved by providing for locked cabinets. There are three drawers with one has a facility for locking which is the largest of all and this locked drawer is used to keep all articles locked when the cart is not in use and

kept stand by. Fig: 2. Such a cart is designed pre-packed to be used at immediate notice. Fig: 3.

We then formulated three mock-standardized drills namely new patient admission, patient care and nursing handover. No human subjects were involved. A Patient Dummy was used. New patient admission drill, included starting of oxygen, placing patient on monitor, IV line placement and starting of IV fluids. Providing routine care, mock drill included sample collection, administration of antibiotics and initiation time of back care and washing. Nursing handover drill included handing over of files and inventory.

Three nurses were randomly chosen and assigned to different mock drills. Each nurse had to perform the tasks with the bedside cart or the traditional centralized supply cabinet model. All the tasks were timed. Time keeping was done with stopwatch in a cellular phone.

Respective nurses were then asked to grade their individual tasks subjectively by means of a Questionnaire with 0 to 10 scoring. We calculated mean scores of all the three mock drills subjective assessments. The questionnaire was simply a lists of tasks routinely carried out by nurses.

No subjective element was present therefore external validation was skipped.

At Six-month post implementation of the cart system we polled all the nurses with six-month experience each in the cart vs non-cart system.

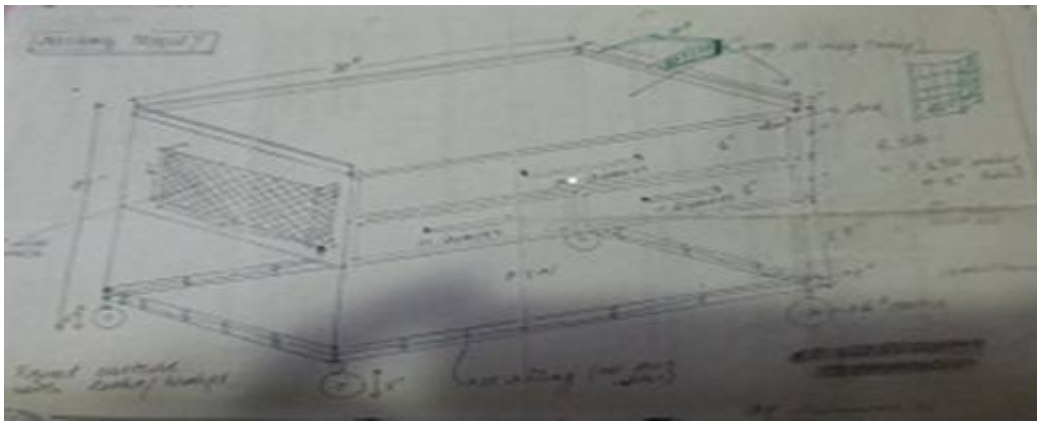

Figure 1: Preliminary Schematic Design

FIRST DRAWER	SECOND DRAWER
VENFLON NO.16	I.V SET
NO.18	Y-CONNECTOR
NO:20	MUCOUS EXTRACTOR
NO:22	POLY MASK
ECG ELECTRODES	NEB MASK
I D BAND	NASAL CANULA
3 WAY	DIAL-A FLO
DUODERM	BLOOD SET
MICROPORE	EXTENSION PRESSURE LINE
NEXCARD	SUCTION CATHETER
TEGADERM	
INSULIN SYRINGE	THIRD DRAWER
ABG SYRINGE	
SYRINGE NO: 50	VACCUM SUCTION SET
NO: 20	GLOVES NO: 6.5
NO:10	NO: 7
NO: 5	NO: 7.5
NO: 2	LABFORMS
NEEDLES NO:18	CONSENT FORMS
NO: 22	SAMPLE BOTTLES
NO:23	
NO:26	BOTTOM SHELF
BANDAGE	
GAUZE PACKET	NS 500ML
BOTTLE SPYKE	NS 100ML
0.45 DNS 500ML	DNS 500ML
0.45 NS 500ML	0.45 DNS 500ML
5% DEXTROSE	0.45 NS 500ML
RL 500ML	5% DEXTROSE
	RL 500ML

Figure 2: Inventory List for the cart

Figure 3: Ready to use cart

Table1: Result of Mock Drill

Task	Time taken with Cart in seconds	Time taken without cart in seconds
Results of Mock Drill # 1 (New Admission)		
Starting O2	10	40
Starting Monitor	40	70
IV Line placement and starting of IV fluid	50	160
Results of Mock Drill # 2 (Patient Care)		

Sample collection	60	120
Administration of Antibiotic	70	100
Back Care and Washing	7	30
Results of Mock Drill # 3 (Handover of Care)		
Files handover	145	180
Inventory	25	35

Table: 2

Post Drill Mean Scores of Subjective Assessment (0= Most Easy/Minimal Effort and 10=Most Difficult/Maximal Effort to accomplish task)

Subjective Scores	With Cart	Without Cart
Mock Drill # 1	0.99	4.38
Mock Drill # 2	0.69	5.19
Mock Drill # 3	0	3.44

Table: 3

Mean Score Subjective assessment of nurses at six month of use

(0= Most Easy/Minimal Effort and 10=Most Difficult/Maximal Effort to accomplish task)

Subjective Scores	With Cart	Without Cart
	0.105	8.36

Results:

Results show a significant improvement in time to complete each task.

10s Vs 40s to start oxygen, 40s Vs 70s to start monitor, 50s Vs 2 min 40s for starting IV fluid, 60s Vs 2 min for blood sample collection, 70s Vs 100s for administration of antibiotic, 7s Vs 30s for initiation of back care and back care/washing, 2 min 25s Vs 3 min for file handover and 25s Vs 30s for inventory handover. (Table 1). An average reduction of about 4 to 5 point reduction in work effort was noticed. (Table 2). A subsequent survey of nurses at six-month reveal that the perception of effort reduction to complete tasks persists after long use.

(Table: 3)

Discussion:

Task completion has to be efficient and multitasking is essential in the complex environment of ICU. Ease of task would result in higher fidelity care and translate in better patient outcomes and staff satisfaction.

Patients should get the care he or she deserves in a timely and in a proper manner, which is directly related to the clinical time spent by the nurse.[12]. There are lots of performance obstacles of intensive care nurse, who is the final caregiver in the process [1]. The compliance to glycemic control, agitation prevention, nutrition, infection control, prevention of medication errors are directly related to quality of nursing care the patient receives. Further, patient safety is directly attributed to their working condition.[12]

Numerous studies have demonstrated benefit of higher nurse patient ratios in hospitals.[4] Trained nursing workforce in ICU is also a scarcity in India and as evident from abroad there is a consequence to it.[5] But, there is cost to increasing workforce, which has to borne by the patients. India is a poor country especially in respect of the healthcare economics. Therefore achieving efficiency should be high priority. Concepts like Lean and 5S have been implemented in healthcare with success.[6,7,8,9.] Thinking from human angle is mandatory in organizing new workplaces. There are a few successful examples that a devolution of power and combining LEAN, 5S and human factors have led to safety and better delivery of care.[10,11] Our focus was to design the bedside cart in an attempt to maximize the time spent by a critical care nurse with his or her respective patient. As we noticed there was substantial improvement in time taken for each assigned task for completion. In addition, the ease task completion was also improved. Encouraged by the results and persistent nurse satisfaction we have implemented this system across our institution.

Limitations of our study were that is it is a single center study, subjective assessment is involved.

Conclusions:

We noticed that after introduction of this new cart system in our ICU, the clinical time spent by the nurse with each assigned patient impressively increased. This has resulted in increased early detection of bad physiology, timely and proper

medication, less medication errors and significant improved outcome.

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