American Journal of Educational Research, 2017, Vol. 5, No. 8, 913-916
Available online at http://pubs.sciepub.com/education/5/8/11

DOI:10.12691/education-5-8-11

Use of Pareto Principle in Designing Critical Care Education Program in Low Resource Area

Ihab B Abdalrahman[1], Shaima Nasr Eldeen Mohamed Elgenaid[2,*]

[1]Faculty of medicine, university of Khartoum, consultant of acute care medicine, soba university hospital
[2]Faculty of medicine, university of Khartoum, Khartoum, Sudan
*Corresponding author

Abstract Pareto rule states that 20% of activates are repeated 80% of time. Critical care required highly competent and well-trained health care providers. In low resource countries, it is challenging and expensive and time consuming to design a comprehensive educational program. We wonder if application of Pareto principle can help in designing critical care educational program. Aim of this study is to assess the frequency of repeated activities and interventions in ICU. This is a cross-sectional study, data collected from ICUs of seven hospitals in Khartoum. Total number of patients was 52 with mean age of 48.3 years and total number of ICU days of study population was 431 days. Regarding nurses' intervention 12 items (44%) were done by nursing staff all the time. out of common lab tests six of them (21.4%) were requested for almost 80% or more of patients. Very few medications (114) out of 1453 drug approved by FDA were ordered to our study population, which represent 7.84%. In conclusion, Pareto principle is appealing in a way that enables us to discover the commonly used activities in ICU. It might be feasible to create an educational program in critical care by starting with commonly done intervention then expanding.

Keywords: *education program, ICU, limited resources, pareto principle, repeated items*

Cite This Article: Ihab B Abdalrahman, and Shaima Nasr Eldeen Mohamed Elgenaid, "Use of Pareto Principle in Designing Critical Care Education Program in Low Resource Area." *American Journal of Educational Research*, vol. 5, no. 8 (2017): 913-916. doi: 10.12691/education-5-8-11.

1. Introduction

Pareto principle was introduced by Vilfredo Pareto (1897) who states that 20% of input is responsible for 80% of the outcome. This was described as Pareto rule or the 20/80 rule. Initially it used to demonstrate the distribution of wealth (80% of wealth is owned by 20% of people) but eventually it has been used to reach the state of work less and achieve more [1]. The rule is applied in marketing and business, 20% of problem account for 80% of quality. 25% of customers are responsible for 80% of store sales. 80% of sales are produced by 20% of accounts. Another application in software development, Microsoft state that 80% of errors and crashes in windows and office are caused by 20% of identified bugs [2].

In medicine many studies were conducted to identify problems using this principle, for instance: 12% of most frequent medical problem account for 80% of all patients' problems, 11.8 % of medication accounts for 80% of all medication orders and 4.5 % of lab result account for most of lab results [3]. In medical education Pareto principle helped in identification of most trainee behavior that need correction by supervisor doctors during laparoscopic cholecystectomy, 28% of verbal correction account for 80% of all corrections, this data can be used for creating strategies to prepare the trainee in order to limit the cost and time in the operating room [4]. 20% of patients who missed heparin doses for venous thromboembolism prophylaxis account for 80% of all missed doses, and this is very useful for intervention [5].

On the other hand in term of ICU management, data is required for creating plans that insure delivery of best care to the patient and getting best outcome.

1.1. Significant of the Study

There are tremendous amount of information used to deliver effective patient care. Sudan, an economically disadvantage country, is experiencing expansion in Intensive Care Units services. Nurses are trained by scattered courses and apprenticeship. Most of the postgraduate nursing degrees are academic. At the time of writing this manuscript, there is only one professional program to award competency based professional diploma in critical care. It will take long time to train enough staff.

The concept of Pareto principle is appealing since in many areas few of the activities are responsible for the majority of the result. We wonder if the same is applicable in designing critical care intervention for nurses.

1.2. Aim of the Study

The main objective of this study is to assess the frequency of activities and interventions done in ICU in low resource area, and to explore if some activities are repeated more than others thus can be used to create critical care educational program.

2. Methods

2.1. Research Design

This is cross sectional observational study was conducted to determine frequently done activities and intervention in ICUs in low resource area.

2.2. Setting

The study conducted from 27-March to 4 of April 2017 in seven different hospitals in Khartoum state, Sudan.

2.3. Subject

Sample was patients admitted to selected ICUs in Khartoum, Sudan. Data was collected from seven ICUs. Three of them were ministry of health; two were private hospitals and one university hospital, one military hospital. Total number of patients was 52.

2.4. Tools of Data Collection

We design data collection sheet that captured information about demographic, clinical, lab tests, imaging and medications used in ICUs, also nursing interventions was collected using the same method from documented data in patient's sheets in ICUs.

2.5. Ethical Consideration

The research proposal was approved by Soba Center for Audit & Research. Permission was taken from hospital administrations. Consent was waived by the research committee. Each ICU was visited one time and the records were reviewed.

2.6. Data Analysis

Data analysis was a computer based analysis using Microsoft Excel software 2010 (windows 7).

3. Results

Total numbers of patients from ICUs of seven hospitals were 52. Males and females were 24 and 28 respectively. Age of the participant ranged from 7-85 years with mean age 48.3 years. Total number of ICU days at the time of assessment was 431, shortest duration of stay was for 1 day and the longest was for 47 days, with mean length of ICU stay 8.3 days. Data showed in (Table 1).

Out of most common lab tests usually ordered in ICU, 35 tests were requested for patients in our study. Regarding imaging, 11 imaging modalities was used in ICU, three of them (chest X ray, CT brain and abdominal ultrasound) was done for about two third of patients. We found that114 medications were given to patients in this study including seven type of intravenous fluid. As showed in (Table 2).

A total of 27 different monitoring processes and interventions done by nursing staff were recorded, 12 of them was frequently done for all patients in our ICUs, including vital signs monitoring and various patients care processes. As listed in (Table 3).

Table 1. Demographic Information About Patients In intensive Care Unit From Seven Hospitals

Hospital name	Number of patients	male	female	Mean age	Mean days of stay	Total Number of ICU days
Ibrahim Malik Teaching Hospital	6	2	4	52.7	20	120
Omdurman Teaching Hospital	7	3	4	46.1	11.1	78
Bahri Teaching Hospital	7	4	3	57.7	4.3	30
Fedail specialized hospital	5	2	3	65.8	6	30
Royal care international hospital	9	5	4	38	5.4	49
Military Teaching Hospital	10	3	7	43.2	6.9	69
Suba university Hospital	8	5	3	45.8	6.9	55
total	52	24	28	48.3	8.3	431

Table 2. The Frequency Of Commonly Ordered Items For The Study Population During Their ICU Stay

Category	Number of items used in ICU
Lab test	35
Imaging	11
Medications	114

Table 3. Monitoring Activities And Interventions Done By Nursing Staff In ICU

number	Nursing intervention and Monitoring	number of patients	%
1.	Blood pressure	52	100
2.	Heart rate	52	100
3.	Respiratory rate	52	100
4.	Temperature	52	100
5.	INPUT-OUTPUT	52	100
6.	GCS	52	100
7.	Oxygen saturation	52	100
8.	ECG	52	100
9.	Bed care	52	100
10.	Bladder care	52	100
11.	Bowel care	52	100
12.	Feeding	52	100
13.	NGT insertion	35	67.3
14.	Endotracheal tube care	25	48.07
15.	Central line care and assist in insertion	24	46.1
16.	Suction	22	42.3
17.	Physiotherapy(chest)	18	34.6
18.	Oxygenation by simple mask	17	32.7
19.	Mechanical ventilation by SIMV	16	30.7
20.	Wound Dressing	11	21.1
21.	Dialysis HD	9	17.3
22.	Tracheostomy care	8	15.3
23.	Mechanical ventilation by CPAP	7	13.5
24.	Oxygenation by NC	6	11.5
25.	Mechanical ventilation by BIPAP	6	11.5
26.	Oxygenation by none rebreathing mask	4	7.7
27.	Drain management	4	7.7

4. Discussion

In this study, we tried to explore the frequency of activities done in ICU to help us design a cost-effective education program for ICU staff in low resource area. It was obvious that the most frequent and important components were nursing care. It is clear that all types of nursing care like monitoring vital signs, measuring urine balance, changing patients position and assessing neural function were done all the time. In low resource area some of the monitoring might not be available due to lack of technology or competency. In this report we notice that among commonly used 27 items for patient care; our nursing staff did 12 items (44%) all the times for all patients on regular bases. Reflecting on the frequency of patient's encounter by provider, it is easy to stipulate that a nurse will encounter or touch her patient at least every hour. If we add to this the number of medication given, adjusting the flow of intravenous fluid or oxygen, cleaning, suctioning, addressing urgent condition and assisting other providers this might double or triple the average number of encounter per day. Nursing work load affect quality of patient care [6]. This call for achieving balance between adequate delivery of care and rational use of resources [7].

In some low resource countries like Sudan, we have less than 20 intensivists. This reflects scarcity and significant shortage in highly trained providers. Add to this fact, most of resident doctors are trainee. These are temporary workers by the time they learn, they move to another training location. All these factors call for alternative way of setting priority in designing critical care training. Focusing on nursing training seems to be the most important facets in developing ICU service in low resource area. It was reported that among the health care teams working in ICU, it is the nursing staff that spends most of time at patient's bedside [8].

There are 85 commonly ordered lab test in ICUs [9] of them 35 (41.2%) are ordered in our ICU. We noticed that 6 lab tests (complete blood count, random blood sugar, renal function test, arterial blood gas, urine analysis and bleeding profile) were ordered 80% or more for patients in our ICU. These 6 tests represent 21.4% of the lab tests ordered in our ICU (35 tests). This fits the Pareto assumption that 20% of your effort is repeated 80% of times. It is interesting to find that there are 25000 available laboratory tests in Logical Observation Identifiers names and Codes (LOING) data base [10]. The frequencies of tests ordered in this study represent 0.14 % of all tests available in the database.

It is reassuring to find that the commonly used laboratory test in this report are good enough to calculate severity scoring systems needed in ICU like APACHE 3, SOFA, SAPS [11]. So in the preparatory phase of education and training we can focus on the commonly repeated laboratory test. For the other test, trainee can use the general principles and they have to refer to available resource to update themselves and upgrade their training.

The same principle is applicable when we assess the medications. FDA approved 1453 medications [12]. Total numbers of 114 drugs were given to patients in ICU including oral, intravenous, intramuscular and inhaled medications; this represent 7.84% of the FDA approved medications. Of this medication 7 were resuscitation fluid. There are 20 Intravenous fluids used for resuscitation in hospitals [13]. Our patients received 35% of the commonly available resuscitation fluids. Out of 85 most common medications used in ICU [9], 35 (41.2%) drugs were given to our patients.

Data analyzed for regular imaging requested for patients during ICU stay, and the results showed 11 (4.02%) out of 273 common imaging methods in medicine were requested [14].

The cumulative number of available interventions for ICU patients (nursing activities + administering medication + common lab test + radiological imaging) were approximately 1838. In this survey we found 172 (9.3%) activities were commonly done in our ICU.

Currently there are more than 500 ICU beds in Khartoum (the capital of Sudan). There are 4-10 ICU beds in all major cities. At the same time there is no structured competency based professional degree in critical car for nursing staff. Most of the nurses go to continuous development courses at their own expenses. Few hospitals provide in-service training. It is intuitive to design our educational program to address the commonly encountered issues. This will help to produce a new breed of providers who are aware of their tasks and relevant to the context. This can provide a fast track to keep pace with the growth of ICU service. We hope this might facilitate proper allocation of resources to be cost effective in resource limited settings. It is rather a quick fix for a broken system. This does not call for ignoring uncommon issues. It is rather about staging the educational process and setting priorities. It is about emphasizing and addressing the current and immediate needs, with a room for growth and continuous professional development.

5. Conclusion

Our study illustrates that few items were frequently done in ICU like patient daily care, investigations, medications and supportive care. Pareto principle is appealing in a way that enables us to discover the commonly used activities in ICU. It might be feasible to create an educational program in critical care by starting with commonly done intervention then expanding. This might help us to optimize the use limited resources.

References

[1] Kock R. *The 80/20 principle, The secret of achieving more with less*, Nicholas Brealey publishing, london, 1998, chapter 1,2.

[2] Rooney P. "Microsoft's CEO: 80-20 Rule Applies To Bugs, not just features," *CRN*, October 3, 2002. Available: http://www.crn.com/news/security/18821726/microsofts-ceo-80-20-rule-applies-to-bugs-not-just-features.htm. [Accessed May 20, 2017].

[3] Wright A, Bates D. "Distribution of problems, medications and lab results in electronic health records: the pareto principle at work," *Appl Clin Inf*, 1. 32-37. 2010.

[4] Kramp KH, van Det MJ, Veeger NJ, Pierie J-PE. "The Pareto Analysis for Establishing Content Criteria in Surgical Training," *Journal of surgical education*, 73(5). 892-901. 2016.

[5] Shermock KM, Lau BD, Haut ER, Hobson DB, Ganetsky VS, Kraus PS, et al. "Patterns of non-administration of ordered doses of venous thromboembolism prophylaxis: implications for novel intervention strategies," *PloS one*, 8(6). e66311. 2013.

[6] R. M. Y. Conishi and R. R. Gaidzinski, "Evaluation of the Nursing Activities Score (NAS) as a nursing workload measurement tool in an adult ICU," *Rev Esc Enferm USP*, 41(3).346-54. 2007.

[7] Lima MK, Tsukamoto R, Fugulin FM. "application of the nursing activities score in patients with high dependency on nursing care," *text and context nursing*, 17(4). 638-46.2008.

[8] Gonçalves, L.A. "Patient Safety in Intensive Care Unit: nursing care time and its relationship with the occurrence of adverse events and incidents," *São Paulo*: *school of nursing university of sao paulo*, 2011

[9] Varon J, Acosta P, Varon J. *Handbook of critical and intensive care medicine*, Spring, New York, 2010 Mar 20.

[10] McDonald CJ, Huff SM, Suico JG, et al. "LOINC, a universal standard for identifying laboratory observations: a 5-year update," Clinical chemistry, 1; 49(4).624-33.2003.

[11] Frassica JJ. "Frequency of laboratory test utilization in the intensive care unit and its implications for large-scale data collection efforts," *Journal of the American Medical Informatics Association*, 1; 12(2).229-33.Mar 2005.

[12] Alexander Gaffney. "how many Drugs has FDA approved in it's Entier history? ", october 2014. Available: http://www.raps.org/Regulatory-Focus/News/2014/10/03/20488/How-Many-Drugs-has-FDA-Approved-in-its-Entire-History-New-Paper-Explains/ . [Accessed April 5, 2017].

[13] Myburgh JA, Mythen MG. "Resuscitation fluids," *New England Journal of Medicine*, 369(13).1243-51.2013.

[14] Main street radiology "2017 radiology CPT codes. Main street radiology", March 2017. Available: http://www.mainstreetradiology.com/File%20Library/pdf/cpt-code-final.pdf . [Accessed June 9, 2017].