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EFFECTIVENESS OF BEDSIDE REMINDER ON REDUCING LABORATORY TEST AND COSTS AT INTENSIVE CARE UNITS

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ABSTRACT

Intensive care units cater to patients with severe or life-threatening illnesses and are very expensive: Any recommendation to reduce the number of avoidable laboratory tests can help lower costs. Laboratory test results are widely used in clinical and public health settings, and the accuracy, reliability, and timeliness of reported test results define the laboratory's quality. The laboratory results must be as accurate as possible, all aspects of the laboratory operations must be reliable, and reporting must be timely in order to be useful in a clinical or public health setting. Avoidable repeat requesting of tests can compensate laboratory workload. We assumed to evaluate how many requests and how much cost reduction could have been saved if red color bedside reminders were seated and patients' beds had been enforced in intensive care units.

Firstly, we extracted the frequency of requests and the cost of laboratory tests such as complete blood count, serum electrolytes, urea nitrogen, creatinine, and blood glucose concentration, prothrombin time, and international normalized ratio for 3 months. Reminders were integrated in the red card format (20 x 30 cm) at the intensive care units over 3 months. A 3-month pre-installation and post installation study was carried out to determine frequency of requests and the cost of laboratory tests.

Overall reminder installation immediately and significantly decreased Average frequency and cost of laboratory test such as complete blood counting, serum glucose, urea, creatinine, serum electrolytes and calcium tests, as well as prothrombin time and international normalized ratio ($p < 0/05$).

Intervention such as reminders installation strategies, may improve the efficient use of laboratory tests. Our study suggests that bedside reminder installation is a simple tool that is used for reducing the number of request tests and costs at intensive care units.

KEYWORDS: Bedside reminder, Intensive care units, laboratory test

INTRODUCTION

Intensive care units (ICU) cater to patients with severe or life-threatening illnesses who require constant care, close supervision of life support equipment. Laboratory tests study and measure multiple aspects of the blood. Laboratory blood testing is the

best common techniques of medical evaluation, used to prepare critical information about limitless features of medical care units. Laboratory tests have traditionally been one of the main mediators used in various fields of medical sciences. General labora-

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tory tests may perhaps support to improve management and diagnosis of most common diseases and illnesses seen in outpatients referring to medical centres and medical care units. Laboratory tests are very practical for identifying and treatment patients in multiple geographical regions. The results of laboratory tests have an critical influence on patients' care, equally they ability physicians' determination as well as entrance [Kobewka D, 2005].

Throughout the decades ago, the numeral of desires for laboratory testing has raised throughout the world. Several Studies have revealed that the most number of laboratory tests are requests in the first 24 hours after hospitalization, accounting for approximately 30% of all patients' trials. Though, the most tests are falsely repeated and unnecessary test ordering can increase the risk of medical errors [Kumwilaisak K, 2008; Rodziejewicz T, 2018].

The directorship of patients intensive care unit (ICU) is a difficult method that contains radiological imaging, and in actual usual laboratory tests. necessary blood sample test, which can be achieved up to more than a few times a day, every day, are used to determine diagnosis, commonly throughout the early part of medical care admissions and additionally assist to screen metabolic illnesses, to notice important organ collapse, and to evaluate the efficacy and adverse effects of management during the ICU admissions.

Conversely, check of repetitive blood sample laboratory tests in ICU is habitually incorrect.

Then preparing extra with fewer is a importance for medical care organizations around the globe, so the request of standard blood sample laboratory tests in intensive care units need to optimized. checking of laboratory mediator is mostly over-used in intensive care units and increment resource advantage. Anemia is the most complication of critical ill patients who was admitted in intensive care units and related with serious outcomes. Phlebotomy associated with laboratory sampling is a possibly adaptable participant. Since that laboratory tests create a serious part of treatment, they should be requested with close regard to interest and harms they have for the patients. For example, cardiac catheterization is related with risks such as bleeding, arrhythmias, acute kidney injury, and myocardial infarction, and appeal for this diagnostic procedure need to careful attention [Beland D

et al., 2003; Corwin H, 2004; Ezzie M, 2007; Kumwilaisak K, 2008; Thakkar R et al., 2015].

Moreover, risk of infection transmission such as HIV and the hepatitis C virus (HCV) was increase with in unnecessary blood sampling. The inability of medical staff to take a sample and repeat the sampling is also one of the problems that threaten the patient [Ellemdin S, 2011; Elseviers M, 2014; Hassanipour S et al., 2021].

Several strategies have been adopted in this regard including the academic interpretation of laboratory tests, requesting tests to change patient conditions, and guidelines for physicians' awareness of the cost of tests required for patients [Thomas RE, 2006].

reminder installation is also one of the important strategies that have gained great research attention especially to intensive care units, it is essential to use appropriate methods to prevent complication of unnecessary and repetitive tests. previous studies have shown that there are no great variations in the results of repeated tests and not a significant patients outcome [Thomas RE, 2006; Attali M et al. 2006; Fakhry M et al. 2011].

The aim of this study was to review the association between the use of bedside reminder and routine laboratory parameters checking in medical intensive care units.

MATERIALS AND METHODS

We managed a pre interventional and post interventional research over an 6-month interval at intensive care units. Pre intervention period last over 3 months from July to September 2019, and the post intervention time last for 3 months from October to December 2019. we extracted the number of requests and the cost of laboratory tests such as complete blood count (CBC), serum electrolytes, urea nitrogen, creatinine, and blood glucose concentration, prothrombin time (PT), and international normalized ratio (INR) for 3 months. Then, reminders were integrated in

*To overcome it
is possible, due to the
uniting the knowledge and
will of all doctors in the world*



the red card format (20 x 30 cm) at the intensive care units over 3 months. An 3-month pre installation and post installation study was carried out to determind frequency of requests and the cost of laboratory tests. All APACHE II data collected from the first 24 hours following ICU admission before and after the intervention.

Statistical analysis: Pre- and post intervention results were paralleled by Fisher's exact test using Statistical Platform for the Social Sciences Version SPSS 26 . A P-value 0.05 was measured to reveal statistical significance.

RESULTS

Data were collected from 67 patients admitted to ICU along with the requested tests within three months prior to the installation of the reminders. After the installation of bedside reminders, data were collected from 69 patients for three months in order to compare the effect of the installation of the reminders with the previous condition.

Out of all patients participating in this study, 83 patients were male (45 before and 38 after the installation of the reminders) and 53 were female (22 before and 31 after the installation of the reminders). The distribution of participants in both groups was the same before and after the installation, and there was no statistically significant difference ($P > 0.05$).

The mean age of the patients was 52.51 ± 19.27 years, varying from 18 to 92 years. The duration of hospitalization at the ICU in this study was 10.07 ± 8.8 days. The mean age of the patients studied was 56.26 ± 16.44 years before and 47.86 ± 21.1 years after the reminder installation. There was no significant difference in the age range of the patients before and after installing the reminders ($P > 0.05$).

The average number of requests for CBC, serum glucose, urea , creatinine, serum electrolytes, as well as prothrombin time and INR before and after the installation indicated a reduction in the frequency of tests, which was significant ($P < 0.05$).

As our observations have shown, the frequency of patients in the intensive care unit for testing laboratory parameters differs before and after admission of patients to the unit. It should also be noted that the number of analyzes of individual indicators also differs from each other (Table 1).

For example, CBC analysis costs 13200 IRR, PT-INR - 30000IRR, blood ssugar - 15000IRR,

blood urea nitrogen and Creatinine (BUN-Cr) - 30000IRR, Na-K - 35000IRR, Ca - 25000IRR, phosphorus - 25000 IRR. From these indicators, the cost of analyzes of the tests carried out changes.

Table 2 shows the average cost of each test before and after installing the reminders at the bedside. The cost of checking CBC, PT, INR, serum glucose, blood urea nitrogen, serum electrolytes decreased significantly after installing the reminders ($P < 0.05$). The average amount of expenditure for serum creatinine level test before the installation of reminder was 42,744 IRR, but after the installation, it dropped to 32912 IRR, though this reduction was not statistically significant ($P = 0.38$) (Table 2).

TABLE 1.

Average frequency of patients' ICU tests per day requests before and after installing bedside reminders

Variables	Reminder setting time (number/day)	
	Before)	After
Complete blood counting (CBC)	1.57	1.04
Prothrombin Time - international normalized ratio (PT-INR)	1.19	0.87
Blood sugar	1.42	0.91
Blood urea nitrogen (BUN)	1.42	0.96
Creatinine (Cr)	1.42	0.96
Sodium (Na)	1.56	1.03
Potassium (K)	1.65	1.07
Calcium (Ca)	0.85	0.40
Phosphorus	39/0	23/0
Total	1.39*	0.91*

TABLE 2.

Comparison of the average cost (IRR) of tests on patients before and after installing bedside reminders

Variables	Average cost (IRR) reminder setting time (number/day)	
	Before	After
Complete blood counting (CBC)	2081.9	1382.6
Prothrombin Time - international normalized ratio (PT-INR)	3573.3	2627.4
Blood sugar	2168.7	1373.2
Blood urea nitrogen (BUN)	4261.4	2884
Creatinine (Cr)	4274.4	3291.2
Sodium (Na)	5342.6	3611.4
Potassium (K)	5845.5	3815.8
Calcium (Ca)	2150	1006.1
Phosphorus	987.9	586.9

DISCUSSION

Intensive care unit is one of the important parts of every hospital, which is dedicated to critically ill patients. there are several proceeding to decrease unnecessary laboratory test request in intensive care units. changing test-request conduct is mindset changes providers [Beland D et al., 2003; Ellemdin S et al., 2011; Kobewka D, Thakkar R, 2015; Iams W et al., 2016]. There is sparse research on the effectiveness of reminders for patients. In one study, Fakhry et al. reviewed the sound effect in washing and hygiene. According to their results, the use of this reminder was effective in improving washing and hygiene conditions. [Fakhry M et al. 2012].

This study paid a close attention to the issue of the cost of unnecessary and repeated tests in ICU . Reviewing the necessity of repeating lab tests, found that repetitive tests for blood count, INR, PT, PTT, blood glucose, potassium, sodium, magnesium, calcium, and phosphorus were not useful for patients. the repetitive tests were unnecessary in most cases and were often associated with com-

plications in patients [Corwin H et al., 2004; Elseviers M et al., 2014; Thakkar R et al., 2015; Bindraban R et al., 2018]. The study by Toll et al. revealed that repetition of tests did not have any benefits over single-time checking for any test, and the repetition of tests was followed by complications and increased costs[Toll AD et al., 2011].

Several studies revealed that repeated tests were not cost-effective at intensive care units [Attali M et al., 2006; Iams W et al., 2016].

CONCLUSION

Study concluded that bedside reminders of laboratory test, influence a important advance to avoid unnecessary repetition of tests among patients and suggested that the repetition of test requests and costs such as CBC, serum levels of glucose, BUN, creatinine, serum electrolytes, prothrombin time, and INR are unnecessary for ICU patients, and do not important roll in patients outcome. Hence bedside reminder installation is a simple tool that use for reducing number of request tests and costs at intensive care units.

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