eICU STUDY: A Proof of Concept

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ABSTRACT

The authors’ objective is to study the effect of eICU (electronic ICU) as a supplementary remote intensive care program on improvement in clinical outcomes. The experiment is designed to determine the clinical usefulness before and after evaluation of the effects of eICU program. The setting is two adult ICU of a large 375 bed teaching community hospital in US. The study was undertaken by group of resident physicians after eICU was started to study the impact on few selected parameters in a teaching hospital. A total of 2537 Patients admitted to ICU between June 2006 to June 2008 (n= 1310 before and n= 1227 after implementation of the eICU) The eICU Program used intensivists and other healthcare providers to give 24x7 supplemental monitoring and management from a remote location. Supporting software and computer based decision support tool were available. The outcome is to study and compare rate of falls, mortalities, incidence of code blues and length of stay between the two periods before and after the implementation of eICU. In the results no statistical difference was observed in the studied parameters thus showing contrary results to other previous studies. The incidence of code blue (39 vs. 54 with P value of 0.36), length of stay (3.0 vs. 3.1 P value 0.36), mortality rates (77 vs. 90 P value 0.28) and incidence of fall (0 vs. 1 P value 0.28) all show no improve outcomes before and after the implementation of eICU.

Keywords: Electronic ICU, Intensive Care Unit (ICU), Physicians, P Value, Teaching Value

INTRODUCTION

The eICU program is an advanced telemedicine solution from the leading providers of remote care to patients in the Intensive Care Units (ICUs). The eICU Program provides an important way to provide high-quality critical care when specialist resources are limited. The eICU have centralized intensivists physicians & critical care nurses round-the-clock in an eICU Center to help bedside teams watch over their sickest patients and to prioritize and guide interventions.

In the eICU model, intensivists and nurses, located in a central monitoring station, use a combination of visual and electronic monitoring and software tools to track care for patients across multiple ICUs in many hospitals. They
use remote-control communication devices to see and hear ICU activities and orally communicate with the ICU. It uses state of the art technology that continuously analyzes trends in patient data, such as vital signs, laboratory and radiological information and thus provides important alerts to the eICU team to changes in the patient’s condition and prompts earlier interventions.

Staff also uses the software to conduct triage by electronically sorting ICU patients according to characteristics such as acuity, diagnosis, and treatment, allowing them to identify gaps in care. Software also supports outcomes analysis, relying on sophisticated risk-adjustment software developed specifically for ICU patients (Acute Physiology and Chronic Health Evaluation, or APACHE), to assess the impact of eICU on patients; acuity as well as on the provision of recommended care.

The eICU program does not replace the on-site staff but instead provides an additional layer of support for the ICU patient.

Objectives: The objective of this study was to evaluate the role of eICU in determining clinical outcomes. The study is undertaken to determine its effectiveness on certain parameters like the rates of ICU code blues, mortality, duration of stay and fall 1 year before and after implementation of eICU model.

METHODS

Design

It was a prospective, controlled, study before and after eICU system implementation at a university hospital. 35 beds in 2 intensive care units were assigned. All patients admitted to the ICU from June 2006 to June 2008 (n = 1310 before and n=1227 after implementation of eICU) were included in the study.

When the patient was admitted to ICU he or she was first registered electronically into eICU system. His laboratory data, vitals and admitting diagnosis are then entered along with complete medical notes.

Interventions

eICU system was introduced in June 2007 at this facility. Intensivists and specially trained nurses use early warning software, video monitoring, physician note and order-writing applications and a computer based decision support tool for monitoring and management of critical care patients 24 hours a day, seven days a week.

Outcomes

Primary clinical outcomes studied were incidence of code blues, falls, mortality rates and mean length of stay.

Statistical Analysis

Chi-square test is used for categorical parameter like mortality and fall by analyzing a 2x2 contingency table and computing the P value by Fischer exact test. Student t test is used for ICU mean length of stay and code blues.

RESULTS

A total of 2537 patients were admitted to ICU over a period of 2 years. Of these 1310 patients were without eICU monitoring and 1227 were monitored with eICU besides the in house monitoring by the physician and the nurses. Specific outcomes measured by patients with normal vs. eICU monitoring were; code blues 54 vs. 39 (p=0.36), falls 1 vs. 0 (p=0.28) and overall mortality 90 vs. 77 (p=0.28). The median length of stay was 3.1 days in those without eICU monitoring and 3 days with eICU monitoring (p=0.36) (Table 1).

When analyzing the mortality numbers by a 2x2 contingency table, the two tailed p value as calculated by Fisher’s test was 0.2826. Similarly the two tailed p value for fall equals 0.4838.

By using paired t test results for the length of stay the two tailed p value equals 0.3654 and the mean difference between the groups equals to -0.1450. The 95% confidence interval of this difference is -0.4830 to 0.1930. For code blues using t test results the P value equals 0.3671.