



Real-Time Intelligence-Driven Medical Decision Making: Application of a Critical Alert System in Clinical Care

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INTRODUCTION

A review of patient safety literature shows that the causes of adverse events are divided into "human or verbal factors (30%)" and "structural or systemic factors (70%)". This study analyzes the patient safety reporting system database and discusses with medical quality personnel to explore trends in patient safety incidents. It is noted that subtle changes in vital signs can be observed 6 to 8 hours before an in-hospital cardiac arrest, highlighting the importance of early identification. This motivates the development and enhancement of the "Early Warning System for Critical Conditions". Using integrated computer software for analysis, the system helps clinical staff detect critical patient safety signs early, enabling more efficient management of emergencies.

AIM

This study aims to develop and implement a "Critical Alert System" to enhance patient safety in clinical care. The system uses integrated computer software to analyze patient vital signs and provide early warnings before critical conditions occur. By continuously monitoring and automatically sending alerts, the system helps medical staff respond quickly to manage patient emergencies, thereby reducing in-hospital cardiac arrest and mortality rates. The objectives of the study include increasing the frequency of monitoring abnormal vital signs, reducing the incidence of adverse events, and improving medical quality and efficiency.

METHOD

This study incorporated a continuous light indicator reminder feature into the 'Patient Progress Record System' and utilized the 'SMS Notification System' to immediately alert medical staff about subtle changes in patients' vital signs. This study utilizes hospital's 'Patient Safety Incident Reporting System,' 'Critical Condition Alert System,' and 'Medical Quality Indicator System' database from 2021 to 2023. Variables included 13 categories of adverse event classifications, 7 major vital signs, inpatient mortality rates, and other related factors. Microsoft Excel 2019 was used for pivot analysis to gain a comprehensive understanding of the system's effectiveness and provide empirical evidence for future improvements.

RESULTS

After implementing the Critical Alert System, the number of alerts increased every year, reflecting greater system popularity and trust, as well as improved process efficiency and sensitivity. Data analysis showed that abnormalities per thousand vital sign monitors increased from 3.10 to 5.22, indicating continuous medical staff commitment to patient safety. Emergency incidents per thousand patient safety reports rose from 12.82 to 25.79, demonstrating effective system integration and application, helping staff promptly detect and manage cardiac arrests. Finally, inpatient mortality decreased from 31.73 to 27.71 per thousand hospitalizations, lower than peer hospital values, highlighting the system's positive impact on reducing in-hospital mortality rates.

Item/Year		110	111	112
Critical Alert System	Total Abnormal Vital Sign Counts (A_1)	47	72	270
	Total Vital Sign Monitoring Counts (B_1)	15168	21008	51704
	Abnormal Counts per Thousand Vital Sign Monitors (A_1/ B_1)	3.10	3.43	5.22
Patient Safety Incident Reporting System	Total Emergency Incident Counts (A_2)	22	37	31
	Total Patient Safety Reporting Incident Counts (B_2)	1716	1471	1202
	Emergency Incidents per Thousand Patient Safety Reports ($A_2/ (B_2)$)	12.82	25.15	25.79
Medical Quality Indicator Decision Support System	Total Inpatient Death Counts (A_3)	1757	1845	1786
	Total Hospitalizations (B_3)	55382	56378	64447
	Deaths per Thousand Hospitalizations (A_3/ B_3)	31.73	32.73	27.71
	Deaths per Thousand Hospitalizations (Hospital Peer Value)	28	32	34

Table 1: Presents data from the Critical Alert System, Patient Safety Incident Reporting System, and Medical Quality Indicator Decision Support System. From year 110 to 112, the number of abnormalities per thousand vital sign monitors in the Critical Alert System increased from 3.10 to 5.22. The number of emergency incidents per thousand patient safety reports in the Patient Safety Incident Reporting System rose from 12.82 to 25.79. The inpatient mortality rate per thousand hospitalizations in the Medical Quality Indicator Decision Support System decreased from 31.73 to 27.71, demonstrating the system's effectiveness in enhancing patient safety and medical quality.

CONCLUSIONS

This study highlights the importance of early identification of subtle changes in hospitalized patients' vital signs. Implementing the "Critical Alert System" enables medical teams to quickly obtain key information and intervene timely, reducing the risk of in-hospital cardiac arrest and death. The system's effective operation alleviates medical staff workload, lowers medical costs, and improves overall efficiency and quality of care, creating a win-win for patients and hospitals. In the future, system functionalities will expand to related fields to comprehensively enhance patient safety.

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