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Improving Utilization of Clinical Decision Support Systems by Reducing Alert Fatigue: Strategies and Recommendations

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Abstract. Clinical decision support systems (CDSS) are designed to help making clinical decisions regarding the management of patients. CDS alerts can save lives but frequent insignificant ones might cause alert fatigue. Studies discuss that 33% to 96% of clinical alerts are ignored. We categorized best evidence based strategies, to reduce alert fatigue and improve CDSS utilization, into five major areas. Classify alerts in to three main levels; severe, moderate and minor then develop a core set of critical drug to drug interactions. Classify alerts into active and passive groups, where only critical alerts should be interruptive actively while less critical alerts should be non-interruptive to the user. Conduct regular user training on new improvements. Keep monitoring alert response rates and keep ongoing research and improvement efforts. Provide systems with automated feedback and learning mechanisms where frequently ignored and justified alerts could be moved automatically from the active interruptive to the passive non-interruptive model.

Keywords. Clinical Decision Support Systems, Alert Fatigue, Improving Utilization, Hospitals.

Introduction

Clinical decision support systems(CDSS) are computer programs designed to help healthcare professionals make clinical decisions regarding the management of patients. Any computer system that deals with clinical data or medical knowledge can provide some sort of decision support [1]. Three levels of decision support functions can be identified. The first includes tools for clinical information management and knowledge browsing. Such systems do not help applying that information to a particular decision task, the interpretation is left to the clinician. The second includes tools for focusing attention, such as clinical laboratory systems that flag abnormal values and pharmacy systems that alert users to possible drug to drug interactions. The third includes tools for providing specific patient recommendations based on specific patient data. They may follow simple algorithms or may be based on cost benefit analysis [2-4]. CDSS generally fall into two categories; systems that assist with deciding what is true about a patient; the correct diagnosis, and systems that assist with decisions about what to do for the patient, tests to order, whether to treat, or what management plan to follow. Many systems assist with both tasks [5].Clinical alerts can save lives, but frequent insignificant ones might cause alert tolerance and then alert fatigue. Alerts sometimes

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highlight insignificant potential adverse effects. Between 33% and 96% of clinical alerts are actually ignored by clinicians [6]. Clinician's alert fatigue is still one of the most significant and chronic problems facing successful implementation of CDSS. If too many alerts are triggered when medications or tests are being ordered, the likelihood is very high that users will eventually ignore or actively override even high severity alerts. Alert fatigue can also cause users to bypass or remain skeptical of CDSS usefulness, resulting in low adoption that impact outcomes and return on investment [7].According to studies, nearly 3,000 prescribers in three American states found that physicians ignored alerts more than 90% of the time [8]. More than a decade of research has found that little has changed in terms of medication alert fatigue. A study in 2004 found that prescribers overrode 80% of the medication alerts triggered in a hospital practice [9].Prescribers overrode 91.2% of drug allergy alerts and 89.4% of the high severity drug interaction alerts, leading the researchers to conclude that one third of the alerts were inappropriate and should be eliminated. Rejection of alerts may reflect the skepticism of users with greater experience about some features of CDSS, such as out-of-date information, identification of interactions that were not clinically significant, failure to note patient tolerance of medication combinations, and the inability to balance the risks and benefits of therapy. It may also reflect a deeper seated resistance among experienced users to the perceived intrusion of information technology into the practice of clinical medicine. This is why education and training is essential to change the user negative impressions and beliefs [10].

1. Methods

Due to the increased percentage of clinical alerts being ignored by users, over 85%, and due to the increased avoidable drug interactions and errors, over 25%, the Medical and Clinical Affairs at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia, worked on identifying best evidence based strategies and recommendations that can reduce alert fatigue among users and improve the utilization of CDSS within the hospital. A careful review of literature was conducted to identify the main approaches, methods and tools to minimize alert fatigue and improve user responsiveness to CDSS alerts. A qualitative survey was also used over six months' duration, first two quarters of 2015, to collect opinions, experiences and suggestions from physicians through an electronic website portal and semi-structured interviews.

2. Results

206 physicians were either interviewed or completed the survey on the electronic website. All reported ideas and recommendations were sorted, validated against published evidence and then categorized into specific functions. The literature review included 53 studies, articles and book chapters; their recommended interventions were also summarized and categorized. Physicians' suggested; classifying alerts into critical and non-critical ones, using colors for the critical alerts, drug to drug interactions should be in a different color, training physicians on how to respond to alerts and reducing number of hard stop messages. The review of literature revealed similar findings in addition to some innovative strategies, such as evaluating significance of alerts and automating the process of classifying alerts levels according to user feedback.

3. Conclusion and Discussion

The combined results of the review of literature and the qualitative survey were categorized into five main strategy areas. The first strategy is to classify alerts, based on their severity, into three levels; severe, moderate and minor, which has been shown to increase compliance rates in many studies by 30 to 50%. Alert messages should be color coded for each level. When alerts are prioritized, differentially presented or limited to critical ones this is may be as important as selecting which alerts are delivered. Clinicians do not object to hard stop alerts when they are classified as higher priority than other alerts because they occurred infrequently. Interrupting clinicians only for more serious interactions makes them more receptive and highly compliant to the alerts [11]. A good point to start from is to develop a core set of critically important drug to drug interactions (DDIs) that everyone needs to watch. A group of experts should be consulted with the goal of identifying critical DDIs used for generating medication related decision support alerts. Candidate DDIs should be assessed based on the consequence of the interaction, severity levels, availability of therapeutic alternatives, monitoring and management options, and the probability of the interaction based on the strength of evidence available in the literature. Only around 30 DDIs are considered to be high risk in most of the literature resources, these include drugs that are contraindicated for concurrent use. Severity may depend on additional factors, such as patient age, conditions or timing of co-administration [12]. The second strategy is to classify alerts and messages into active and passive groups, where only severe critical alerts should be interruptive to the user workflow when displayed actively on the computer screen, while moderate and minor, less critical, alerts should always be non-interruptive to the user, passively populated to a side screen, that should be accessible to users on their convenience. This strategy also needs the efforts of an expert panel to rate the alerts and interactions. Low priority DDI that do not warrant being interruptive alerts in CDSS should be identified to help reducing alert fatigue across CDSS; in some studies by 36% [13]. The third strategy is to conduct regular orientation and training programs to educate users about the new improvements so they would expect that the alerts are becoming more serious and no minor alerts would be applied actively, so every appearing alert worth attention and response. User training on CDSS is generally important for the successful implementation of such systems. System developers should always inform users on how much work is needed to get the CDSS operational, developers should also inform users on how much training is needed to use the system appropriately and/or understand the systems' recommendations. This single factor can double the speed of compliance and support the responsiveness [14]. The fourth strategy is to keep monitoring alert response rates and keep ongoing research and improvement efforts. It is still important to monitor the general alerts overriding and ignoring rates and use the resultant data to reclassify the severity of alerts that are frequently overridden or ignored. It is also important to meet and interview CDSS users to evaluate and eliminate or adjust the severity level of certain alerts in order to reduce the number of alerts triggered and consequently reduce alert fatigue. It is important to tack users' responses to learn more about their compliance with the alerts and their reactions. This is how the systems could provide greater control over when and how alerts are presented. This should be available for the hospital as well as for the individual clinicians, to allow end users to customize alerts according to specialty, or to suppress certain alerts such as those for medications a patient has already received. As a result, fewer alerts are triggered; this can get clinicians respond positively more than

60% of the time [15]. The fifth strategy is to provide the CDSS with automated system feedback and learning mechanisms, where users can justify their alert overriding or ignoring through a multiple choice or free text feedback messages that could inform systems, system developers and CDSS experts on why users did not respond to such alerts, override or ignored them, so they could plan eliminating those repeatedly ignored ones, as long as they are irrelevant, insignificant or minor after a quantitative and qualitative analysis of user feedback. At this level, some alerts could be moved automatically and flexibly from the active critical interruptive model to the passive less critical non-interruptive model based on the frequency and strength of the justified and informed user overriding or ignoring behavior. This can spare the development team more than 70% of ineffective customization workload and time [16].

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