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Addressing Alert Fatigue to Improve CDSS Acceptance

Clinical decision support systems (CDSS) are increasingly relied upon in modern outpatient care to assist physicians in avoiding clinical errors and enhancing patient safety. However, the usefulness of these systems is frequently compromised by alert fatigue—a phenomenon caused by the excessive frequency and low relevance of alerts. Physicians, inundated by pop-up notifications, may begin to overlook important information, thereby diminishing the very benefits CDSS was intended to provide. In response to these challenges, a study conducted in an academic medical centre in Taiwan examined the factors shaping physicians' perspectives on CDSS alerts using the Technology Acceptance Model (TAM). This model helps assess the interplay between perceived usefulness, perceived ease of use, user satisfaction, attitudes toward usage and behavioural intention. By exploring these dynamics, the study aimed to provide actionable insights for improving the design and implementation of alert systems.

Physician Characteristics Influence System Perception

The study surveyed 72 physicians using a structured TAM-based questionnaire, analysing how variables such as age, clinical experience, patient volume and consultation frequency influenced system acceptance. Results indicated that physicians with heavier patient loads and those of older age reported lower perceived usefulness and ease of use of CDSS alerts. This was likely due to heightened cognitive burden and more frequent exposure to alerts, leading to greater alert fatigue. In contrast, physicians with greater clinical experience found the systems more intuitive and beneficial, potentially because of their familiarity with clinical processes and alert integration.

The data showed that age and patient volume negatively impacted perceived usefulness (PU) and perceived ease of use (PEOU), while clinical experience contributed positively to both. These findings underscore the importance of considering user demographics in CDSS design. Tailoring alerts to meet the needs of high-volume or older clinicians could mitigate resistance and foster greater acceptance. Furthermore, the study's findings suggest that simplifying interfaces and adjusting alert sensitivity based on the user's experience level may help maintain engagement across diverse physician populations.

Key Relationships Between TAM Constructs

By applying the TAM framework, the study also examined relationships between system perceptions and behavioural intention to use alerts (BI). A clear linkage emerged: PEOU strongly influenced PU, which in turn affected attitudes toward usage (AT) and user satisfaction (US). Both PEOU and PU were found to significantly shape users' attitudes and satisfaction. Interestingly, while satisfaction correlated with positive attitudes, it did not significantly predict behavioural intention. Instead, practical attributes such as ease of use and perceived usefulness were more closely associated with the physicians' willingness to continue using CDSS alerts.

This insight suggests that merely making physicians content with the system is not enough to ensure continued engagement. What matters more is that the alert system is easy to navigate and demonstrably improves clinical workflow. If alerts are perceived as relevant and efficiently integrated into the routine, physicians are more inclined to use them, regardless of whether they find the overall experience gratifying. Consequently, alert systems should prioritise usability and impact over aesthetic satisfaction or redundant design features.

Alert Design: Customisation and Context Sensitivity

The findings revealed dissatisfaction with current alert designs, particularly regarding administrative alerts. Physicians often encountered more than ten pop-ups per patient, many of which were deemed irrelevant, thereby hampering workflow and contributing to alert fatigue. Suggestions for improvement included consolidating alerts, reducing frequency and prioritising those with high clinical value. Physicians also called for smarter alert systems that adapt based on context, clinical roles and workload.

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To this end, artificial intelligence (AI) integration could offer substantial benefits. By analysing real-time clinical environments, AI can modulate when and how alerts are presented—delivering only the most relevant notifications at crucial moments. This context-sensitive approach could replace the traditional rule-based system, aligning with the 'CDS Five Rights' framework: the right information, to the right person, in the right format, through the right channel, at the right time. For example, clinical alerts might be delivered via pop-ups, while administrative reminders could be minimised or colour-coded to reduce disruption. Hospitals are also encouraged to involve high-volume physicians in system design and evaluation processes, ensuring that the tools they depend on meet their operational needs effectively.

The study provides vital insights into the factors influencing physician engagement with CDSS alerts in outpatient care. It demonstrates that age, patient volume and clinical experience all shape how alerts are perceived, with ease of use and usefulness emerging as the most critical drivers of behavioural intention. Satisfaction alone does not predict sustained use, making it imperative for developers to focus on functionality and relevance. Physicians showed a clear preference for well-timed, context-aware alerts and expressed concern over the inefficiency of current systems dominated by low-value administrative notifications.

Designing systems that account for user characteristics and workflow demands—particularly by leveraging AI for adaptive alerting—can help overcome alert fatigue and enhance clinical efficiency. These insights not only inform developers and hospital administrators but also guide policy direction toward smarter, clinician-centred CDSS implementation. With targeted improvements, CDSS alerts can better support clinical decision-making and patient safety, fulfilling their promise in modern healthcare.

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