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Paper Title: Meta-analysis on the Prevalence and Impact of False, Nonactionable, and Nuisance Alarms in Critical Care Environments

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Abstract

This meta-analysis aims to provide insights into the prevalence of nuisance alarms in physiologic bedside monitoring within intensive care unit (ICU) settings. Through a systematic synthesis of prevalence studies, a meta-analysis was conducted using inverse variance weighting. A comprehensive search was conducted to identify relevant studies for inclusion in the meta-analysis. The selection criteria were defined, and the quality assessment of the included studies was performed using the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) tool. The estimated prevalence of nuisance alarms was calculated based on the pooled data from the selected studies. The heterogeneity among the included studies was evaluated using Cochran's Q test and I² statistic. Statistical significance was set at $p < 0.05$ to determine the presence of significant heterogeneity. The meta-analysis revealed an estimated prevalence of approximately 70% [0.708 (95% CI: 0.547-0.830, $p < 0.01$)] for false alarms in ICU monitoring. These findings underscore the urgent need to address this prevalent issue in healthcare settings. The identified themes highlighted the significance of reducing false alarms to improve healthcare provider efficiency, enhance patient safety, and optimize alarm management practices. The evaluation of technical relevance, including oxygen saturation, electrocardiogram, and arrhythmia algorithms, emerged as a critical factor in reducing clinically irrelevant alarms. Understanding the sources of false alarms, such as ventilators, cardiovascular monitors, pulse oximeters, and capnography, is essential for improving device performance and minimizing false alarm rates. This meta-analysis provides valuable insights into the prevalence and themes of nuisance alarms in physiologic bedside monitoring in ICU settings. The high prevalence of false alarms emphasizes the need for concerted efforts to mitigate this issue. By addressing the identified themes and implementing evidence-based strategies, healthcare providers can enhance alarm management practices and optimize patient safety in ICU settings. Further research and advancements in medical engineering are warranted to refine alarm systems and improve their reliability.
