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Melodic Medical Equipment Alarms: Are They Safe?

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Background. A recent international standard for alarms on medical equipment (IEC 60601-1-8) recommends melodic alarms, based on Block et al. [1]. However the alarms did not undergo formal usability testing. Subsequent tests suggest that participants from the general population consistently confuse certain melodic alarms [2,3]. Further tests are needed with healthcare professionals under conditions more representative of patient monitoring.
Objective. The goal was to test whether healthcare professionals would show adequate levels of learning and transfer to a monitoring condition in which attention was shared between identifying the alarms and performing another task.
Method. Fourteen nurses learned to associate melodic alarms with labels (eg "cardiovascular" or "infusion"). On Day 1, nurses engaged in self-paced learning for no longer than 40 minutes. On Day 2, a week later, nurses' long-term retention of the alarms was tested then learning was resumed. Then nurses transferred to a test in which single alarms or pairs of alarms sounded at unpredictable time intervals. Alarm pairs played in sequential, partially overlapping or nearly completely overlapping configurations. For half the trials nurses were distracted with a concurrent mental arithmetic task.
Results. Nurses' learning was no better than that of non-nurses in previous studies. Nurses showed previously-noted confusions between the melodic alarms [2,3]. Overlapping alarms were difficult to identify, reducing to chance levels in the nearly completely overlapping configuration. The concurrent task affected response time but not accuracy.
Discussion. Two training sessions were inadequate for healthcare professionals to discriminate the IEC 60601-1-8 alarms with acceptable accuracy. Further research should determine training time needed for acceptable performance. Directives to avoid overlapping alarms should be strictly heeded, but may be difficult in practice. Medical equipment display innovations should be tested with representative human end-users early in design. We will discuss results of further studies and design innovations.

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