Preventing Ventilator Alarm Fatigue

**Before you silence that next nuisance alarm, be sure to read this article**

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Ventilator alarm fatigue continues to be a serious problem that directly affects patient safety. Frequent ventilator alarms often desensitize health care providers, or the alarms can blend in with other accustomed sounds in the intensive care unit. Ventilator alarms that go unnoticed for extended periods of time often result in permanent patient harm or death.

The intensive care unit can be a stressful and noisy environment that can distract health care providers because of the many different monitoring systems. For example, a typical ICU may have more than 40 alarm sources such as ventilators, electrocardiograms, arterial pressure, pulse oximetry, perfusion pumps, nutrition pumps, automatic syringes, dialysis systems, and bed monitoring alert systems. One ventilator on the market has 111 different alarm features listed in the operator's manual.

Alarm fatigue or nuisance alarms continue to be listed by ICU personnel as one of the most annoying environmental problems. In a recent survey, health care providers identified that false alarms or nuisance alarms occurred 81 percent of the time and that they distrusted the alarm devices. Often health care providers simply silence ventilator alarms without notifying other health care team members, which could lead to sentinel events. The health care providers might not realize that when they silenced the alarm for a brief time they subsequently disabled or silenced multiple internal alarms that would normally sound to alert changes in the patient's status.

In 2002, the Joint Commission published a Sentinel Event Alert entitled the "prevention of ventilator-related deaths" in which 23 deaths or injuries were reported. They found that 87 percent of the incidents were related to inadequate orientation/training; 22 percent were related to alarm off or set incorrectly, no alarm for certain disconnects, or the alarm was not audible in all areas.

**Purpose of ventilator alarms**

Patients in the modern hospital ICU environment range from the micro preemie to the morbidly obese. This requires health care providers to be familiar with age-appropriate vital sign ranges and have a thorough understanding of normal physiological parameters. Unfortunately, many of our patients have abnormal vital signs and physiological parameters, and yet we are faced with the admonition of "do no harm" in trying to provide mechanical ventilation for them.

The interaction between the patient and the mechanical ventilator is one of the most complex tasks to coordinate in the ICU. All available monitors provide reliable information both on the setting parameter and the recognition of adverse events. Often the audible alarm systems are based on settings that trigger an alarm to notify health care providers about safe patient care.

Regardless of the type of alarm, it is necessary to set the threshold alarm limit. Although, there is no standard for default alarm setting from one monitoring system to another. Some mechanical ventilators allow health care providers to "autoset" alarm parameters based on the current measured parameters. This can be helpful when the patient is deteriorating; however, multiple alarms can have a distracting effect on the health care provider working directly at the bedside.

The priority in alarm management is first to recognize and locate the source of the alarm and determine its significance. For experienced health care providers, locating the alarm is determined by the different sounds produced by the equipment. The interpretation of an alarm event by health care providers can depend on their experience working in ICU, their knowledge about the equipment, and their ability to intervene during non-emergency situations.

For example, a patient who is disconnected from a ventilator produces the same audible alarm as a high level of minute ventilation. In the first case, the alarm is vital for the patient, but in the second case it may be related to ventilator settings and is not immediately critical to the patient. Yet, what are bothersome are the repetition, loudness, and continual nuisance of the alarms when after analysis of the problem the equipment does not allow for silence.

**Classifying alarms**
The concept of urgency to respond to alarm events has been an area of concern among critical care professionals. The European Committee for Standardization has established a standardized classification system to assist health care providers with alarm signals.³

- **High priority:** urgent situation; requires immediate attention
- **Medium priority:** dangerous situation; quick response needed
- **Low priority:** alert situation; providers' attention needed.

Health care providers can be trained to understand the alarm signal composition, characteristics, and priority level. For example, ventilator alarms of high priority are those related to electrical or pneumatic failure or high airway pressure. Disconnection, apnea, low respiratory ventilation, or high or low concentrations of dioxygen during inspiration are alarms of least or medium priority. When health care providers have an understanding of how the ventilation alarm equipment works they can be more cognizant to respond to an alarm event.

The American Association for Respiratory Care developed a clinical practice guideline on "patient-ventilator" system checks that requires health care providers to verify and document that appropriate alarms are activated.⁴ Additionally the AARC published a consensus statement suggesting that alarms be classified into three levels.

- **Level 1** refers to events that are immediately threatening if left unattended for short periods of time (e.g., power failure, apnea);
- **Level 2** events are potentially life threatening if left unattended for longer periods of time (e.g., circuit leak, PEEP alarms, autocycling);
- **Level 3** are non-ventilator events that are not likely to be life threatening but a possible source of patient harm if not addressed.⁵

Alarms on modern 510K approved mechanical ventilators generally follow a system that prioritizes alarms based on the "potential for harm" to the patient. High priority, medium priority, and low priority are common approaches to classifying and alerting health care providers. Visually, the high priority alarm is displayed in red, and medium priority is yellow. Due to the busy noisy environment in the ICU, some manufacturers now have a visual screen alarm that can be viewed for 360 degrees.

Logbooks containing alarm history and the settings at the time of the alarm are now available from 24 hours to seven days, and this feature will increase in the future to document any adverse event. Reviewing data related to "root cause analysis" will become the standard of care.

**Future solutions**

Addressing ventilator alarm issues requires a systems approach. All medical devices in the ICU need algorithms that are artifact tolerant and provide automatic corrections. Alarms need to be set according to the patient and health care providers' needs. A "one-size fits all" alarm policy often works against good patient safety practices. However, one essential component is to emphasize ventilator alarm settings with the nurse. Often, if nurses have an understanding of the different alarm settings, then promotion of patient safety can be more effective and productive.

Perhaps, a multidisciplinary training program about ventilator systems and certification may be required. As more and more patient safety standards are required, all health care providers will be held accountable for their actions. The ventilator technology of the future may incorporate "fail-safe" devices, yet teamwork and communication remains one of the most important approaches to successful alarm safety in the ICU.

**References**

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