Prevalence and Characteristics of Infusion Pump Alarms in the ICU: A Retrospective Data Analysis

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BACKGROUND

Alarms impact patient safety, healing and the environment of care. The technology laden ICU presents a unique challenge in addressing alarms, with alarm occurrence as high as 45 times/patient/hour[1] and 77% ineffective or ignored.[2] While infusion pump alarms have been found to contribute to approximately 10-12% of ICU alarms,[1,2] compared to other medical device alarms, pump alarms can last the longest[2] and can account for approximately 5% of infusion time.[3]

PURPOSE

The purpose of this study was to evaluate the prevalence and clinically relevant characteristics of infusion pump alarms in the ICU environment. Alarms were quantified based on frequency, duration, type of alarm, type of infusion, time of day and day of week.

METHODOLOGY

Retrospective infusion data was collected for the period May 2013 through April 2016 from **55 ICUs across 29 U.S. hospitals**. All were using the same model large volume infusion pump and on-site infusion management application (DoseTrac® B. Braun Medical Inc.):

- Data was HIPAA de-identified and transferred to a central server.
- ICU data was identified by the programmed drug library care unit and was extracted and analyzed using Microsoft SQL server.
- Data included a combination of adult and pediatric ICUs.
- Hospitals ranged in size from 62-942 beds.

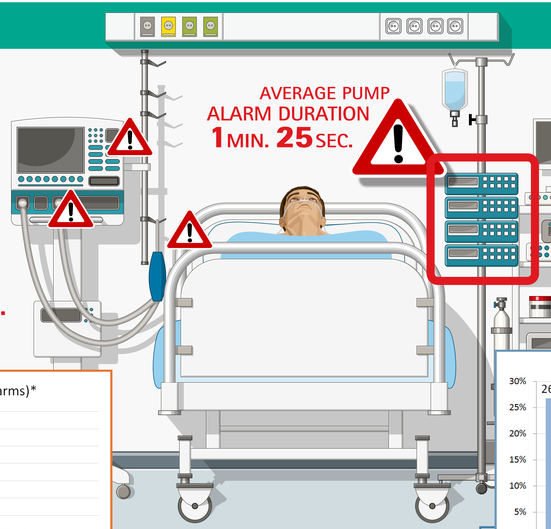
RESULTS

Data was collected from **9,151 pumps**

There were **673,583 alarms** across 291,091 infusion deliveries

Average alarms per delivery = **2.3**

Average alarm duration = **1 min. 25 sec.**

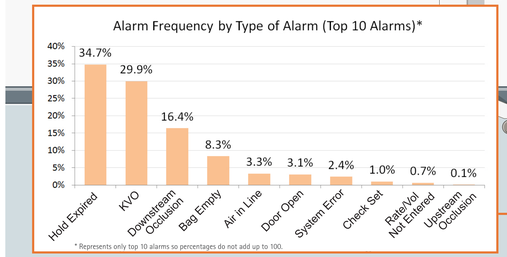


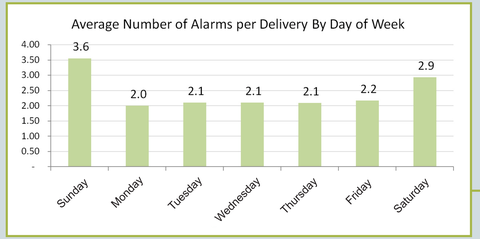
0.3% of time in alarm state

99.7% of time in non-alarm state

5,786,530 active infusion hours

15,854 alarm hours



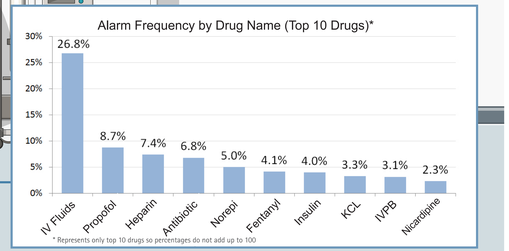


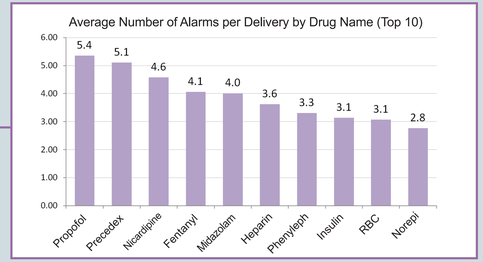
The 3 most common alarms were (1) hold expired (34.7%), (2) KVO (29.9%) and (3) downstream occlusion (16.4%).

The highest percentage of alarms occurred with **IV fluids** (26.8%).

Propofol had the highest number of alarms per drug delivery (mean = 5.4).

There was a higher average number of alarms per delivery on Sundays (3.6) and Saturdays (2.9) versus weekdays (2.0 – 2.2).





CONCLUSION

This study has provided insight into the type and frequency of pump alarms across 55 ICUs in 29 hospitals. While the study showed an average of 2.3 alarms per delivery and average alarm duration of 1 min. 25 sec., it also revealed that **pumps in an alarm state represented only 0.3% of the total infusion time.**

Based upon these findings, opportunities exist for awareness and education related to measures that could potentially decrease unnecessary alarms. Examples include adjusting pump configurations, reinforcing best practices to avoid preventable alarms and assessing weekend staffing and resource support. Future studies could assess the effectiveness of implementing some of these interventions and measure their impact on frequency of pump alarms.

Limitations of the study include:

- Data summary represents only one infusion pump model and was limited to 29 hospital sites.
- Variation in hospital bed size, number of pumps, acuity and dataset size could impact results.

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