Telemetry, Alarm Fatigue, and the Monitor Technician:
Patient Safety in the Surgical Intensive Care Unit at The Johns Hopkins Hospital

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1 Background

Studies have demonstrated that 80 to 99% of telemetry alarms in critical care and intermediate care units are either false or clinically insignificant (Cvach, 2012). Frequent alarms are a distraction from important clinical tasks, and in excess can result in caregiver apathy and desensitization.

The role of a monitor technician is to monitor the telemetry vital signs of multiple patients. Monitor technicians exist in 61% of surveyed United States hospitals, and in many of those hospitals are responsible for watching more than 40 patients at once (Funk, Ruppel, Blake, & Phillips, 2016). Monitor technicians are in place solely as a risk management initiative, and do not provide a billable service (Maria Cvach, personal communication, 2016), which is why some hospitals, including The Johns Hopkins Hospital (JHH), have begun to eliminate the position altogether. According to Karen Earsing, Nurse Manager of the Surgical Intensive Care Unit (SICU) at JHH, the SICU was the hospital's last intensive care unit (ICU) to remove the position (personal communication, 2016).

The monitor technician position was removed August 1, 2016. Alarm data from 10 months (5 months prior to and 5 months following the removal of the position) was collected and analyzed in this report. Separately, data was also collected regarding compliance with The Johns Hopkins Hospital policy that requires ICU Registered Nurses (RNs) that are assigned two patients to display the telemetry data of both patients on each patient's monitor.

Each JHH ICU records four types of telemetry alarms: system, advisory, warning, and crisis alarms. These alarms are compiled into a comprehensive spreadsheet on a weekly basis. An example of a system alarm is "Change Battery," while examples of crisis alarms are "Asystole," "V-fib," and "V-Tach" (Information Technologies, n.d.) The report's main goal is to provide feedback to the units so that RNs may make an effort to decrease the number of alarms they experience per bed per day.

2 Objectives

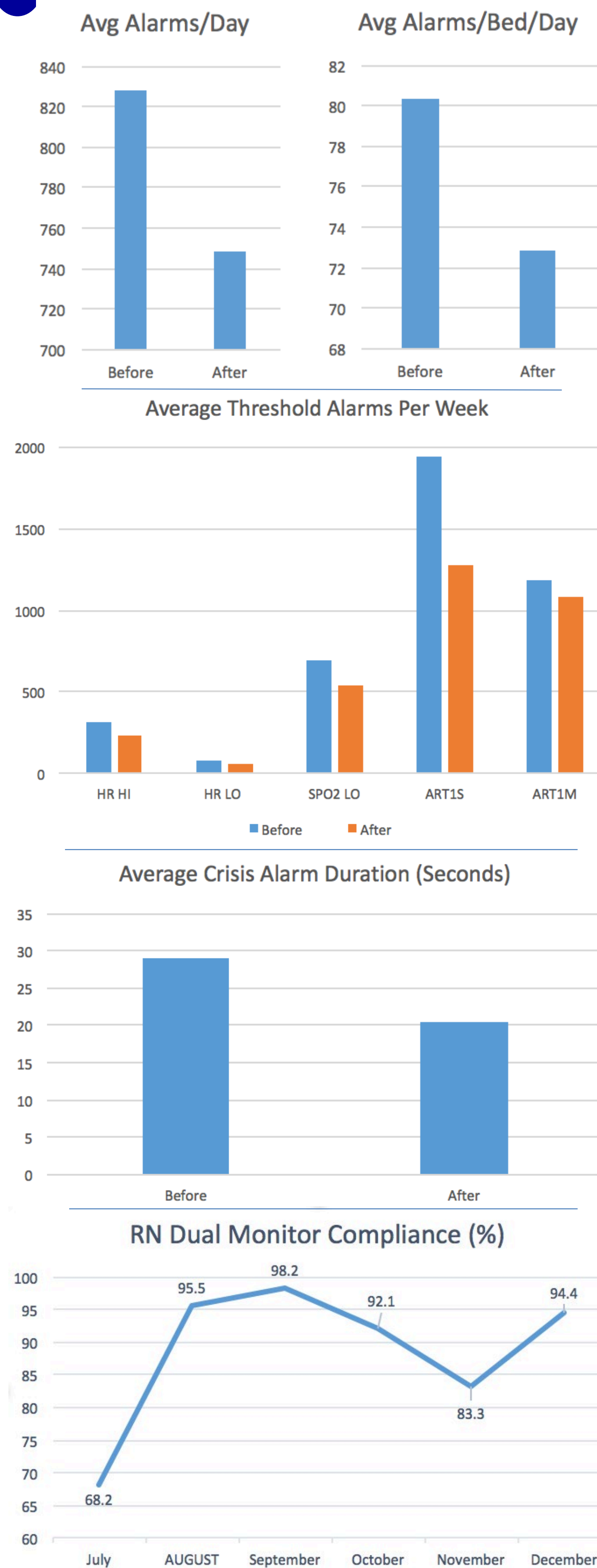**Will the elimination of the monitor technician position in the JHH SICU reduce the number of alarms/bed/day?**

1) Analyze the number of total alarms/bed/day before and after the removal of the monitor watch technician role.
2) Analyze the number of threshold alarms per week before and after the removal of the monitor watch technician role.
3) Analyze the compliance percentage of RNs utilizing dual-patient telemetry data on their monitors.
4) Determine the efficacy of eliminating the monitor technician role as it pertains to patient safety, average alarms per bed, and overall alarm fatigue.

3 Methods

Plan, Do, Study, Act

- **Plan** - Literature review on alarm fatigue and the use of monitor watch technicians in both ICUs and medical-surgical units. Best method of collection and data type were determined.

- **Do** - Data collection on the number and type of alarms per bed per day in the SICU from February 28, 2016 to December 31, 2016. Data collection on dual telemetry data compliance beginning July 1, 2016 and ending December 31, 2016.

- **Study** - Data was divided at August 1, 2016, the date the unit started functioning without a monitor technician. Data from 1 week pre-elimination and 1 week post-elimination was discarded to control for inaccuracies as RNs became accustomed to the change. Paired T-Tests were run on the resulting data to compare alarms before and after the removal of the position. Dual-telemetry data compliance was collected and monthly percentage was calculated.

- **Act** – Statistical data was analyzed to determine correlation between the elimination of the monitor watch technician role and the number of alarms per bed per day. Staff was educated on the importance of utilizing dual-telemetry monitor data as well as methods to decrease the number of alarms per day for each of their patients.

4 Results

Avg Alarms/Day

Avg Alarms/Bed/Day

Average Threshold Alarms Per Week

Average Crisis Alarm Duration (Seconds)

RN Dual Monitor Compliance (%)

- The average number of alarms per day decreased from 828.5 to 748.3

- The average number of alarms per bed per day decreased from 80.1 to 73.3

- The average number of HR HI alarms per week decreased from 314.3 to 232.6

- The average number of HR LO alarms per week decreased from 83.6 to 62.0

- The average number of SPO2 LO alarms per week decreased from 697.8 to 546.4

- The average number of ART1 S alarms per week decreased from 1937.8 to 1241.2

- The average number of ART1 M alarms per week decreased from 1182.3 to 1104.2

- The average crisis alarm duration decreased from 29.0 seconds to 20.4 seconds (Johns Hopkins, n.d.)

- The RN dual monitor compliance began at 68.2% in July and then reached 98.2% by September before falling to 83.3% in November, ultimately reaching 94.4% by December

5 Analysis

The alarms/bed/day goal in all of the ICUs at JHH is at or below 80 (K. Earsing, personal communication, 2016). Prior to the removal of the monitor watch position, the number of SICU alarms/bed/day was just over 80. While not a statistically significant decrease, the average of 73.3 after the position's removal successfully met this hospital goal.

While total alarms/bed/day is an important contributing factor to RN alarm fatigue, according to Maria Cvach, the current director of policy management at JHH, threshold alarms are the most accurate. Threshold alarms are also most often true alarms, as opposed to dysrhythmia alarms which have a higher likelihood of being false (personal communication, 2016). While all of the five most common threshold alarms decreased in frequency after the removal of the monitor technician position, only SPO2 LO (oxygen saturation) and ART1 S (arterial line systolic) experienced statistically significant decreases.

The most notable decrease, and perhaps the one most closely linked to patient outcomes, is the statistically significant decrease in average crisis alarm response time. Additionally, over a 6 month period, the average dual monitor compliance by SICU RNs was 90.4%.

6 Conclusions

The elimination of the monitor technician position correlated with a decrease in the number of alarms per bed per day, but this decrease was not statistically significant. While the reduction in alarms could be the result of broader alarm parameters set by the RNs, it could also be a random occurrence. Additionally, despite a decrease in total number of alarms, the number of monthly crisis alarms experienced a slight increase. Without a full-time researcher observing and recording patient outcomes associated with this data, the true impact on patient safety and quality of care cannot be determined. Regardless, any decrease in alarms per bed per day will, by default, contribute to decreasing the alarm fatigue experienced by ICU nurses, and therefore increase their vigilance in responding to telemetry alarms.

7 Recommendations

Without an on-unit presence determining crisis alarm validity and monitoring patient outcomes associated with the lower number of alarms per bed per day, it is difficult to associate the difference in alarm prevalence with patient outcomes. A study with a longer period of data collection before and after monitor technician position elimination, combined with a full-time researcher to record alarm-associated patient outcomes, would be required to determine the true efficacy of removing the role of ICU monitor watch technician.

8 References

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