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Resident Led Tele-intervention Program: An Impactful Strategy to Reduce Inappropriate Use

Swapnil Patel[1], Mohammed Shariff[1], Jay Shah[1], Natasha Campbell[1], Shreya Gor[1], Anas Alrefaee[1], Ijaz Khan[1], Arman Mushtaq[1], Mohamed Bakr[1], Christian Kaunzinger[1], Michael Carson[1], Elliot Frank[2], Mohammad Amir Hossain[1, *], Kim Carpenter[2], David Kountz[1], Kenneth Sable[2], Tushar Vachharajani[3], Arif Asif[1], Adam Kaplan[1]

[1]Department of Medicine and Hospital Medicine, Jersey Shore University Medical Center Hackensack Meridian Health, Neptune, USA

[2]Department of Quality and Performance Improvement, Jersey Shore University Medical Center Hackensack Meridian Health, Neptune, USA

[3]Glickman Urological & Kidney Institute, Cleveland Clinic, Cleveland, USA

Email address:
Mohammad.Hossain@HackensackMeridian.org (M. A. Hossain)

[*]Corresponding author

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Abstract: Multiple studies have documented an inappropriate and excessive use of telemetry during hospitalization. In this IRB approved study, we report the impact of a focused residents led intervention program on reducing inappropriate telemetry use. The study included two groups. The house-staff covered patients (the intervention group) received the intervention. The non-house-staff covered patients did not receive the intervention and served as the control group. The intervention included the implementation of American Heart Association cardiac monitoring guidelines, daily tele-census and indication evaluation, and discussion around telemetry status during multidisciplinary rounds. Data were collected from the pre- (90 day) and post intervention (90 day) periods for both groups. The intervention resulted in a 49% relative decrease in the average telemetry days in the intervention group (pre-intervention=5.7 days vs. post-intervention=2.9 days; $p<0.001$). The number of patients maintained on telemetry for >48 hours also decreased by 56% in the intervention group. Overall, there were 9 less tele patients/day during the post intervention phase occupying a high cost tele-bed in the intervention group ($8,141 saved/day) and there were 810 less tele patients for the duration of the study. A resident led intervention program reduced inappropriate use of telemetry and minimized costs without compromising patient safety.

Keywords: Telemetry, Cardiac Monitoring, Quality Improvement

1. Introduction

In the era of value-based care and "choosing wisely", both health systems and providers must collaborate to improve patient care and minimize costs [1]. Value-based care is a model of health care delivery system in which both hospitals and providers are paid based on patient health outcome against the cost of delivering the outcomes [1]. In this context, care delivery is emphasizing the right type of care, for the right reasons, delivered in a timely fashion to the right type of medical condition. Multiple studies have documented the inappropriate use of telemetry during hospitalization [2-7]. Because the use of telemetry requires staff and equipment, its inappropriate use is associated with increased hospital costs and a longer length of stay without a demonstrable improvement in patient care or safety [6].

A number of factors have been documented to result in the inappropriate utilization of telemetry [2-8]. Insufficient knowledge of the American Heart Association (AHA) guidelines for telemetry, lack of optimal awareness and

ownership of telemetry implementation, duration of ongoing monitoring and the timing of its discontinuation remain the most important elements [2-6]. Taken together, these factors alone or in combination drive the inappropriate use of telemetry.

We created a resident led intervention program to minimize the inappropriate use of telemetry at our academic medical center. Herein, we report the findings of our systematic approach to reducing inappropriate tele monitoring by engaging and empowering resident teams.

2. Methods

Adult patients (18 years and older) admitted to non-intensive care unit telemetry beds at our institution were included in this analysis. Data were collected from two time periods. In the pre-intervention period data on telemetry were collected using chart reviews (retrospective) from May 2018 to July 2018. In the post-intervention period data were collected prospectively from October 2018 to December 2018. The study included two groups. The house-staff covered patients (the intervention group) received the intervention. The non-house-staff covered patients did not receive the intervention and served as the control group (CG).

2.1. The Intervention

The internal medicine residents led the intervention. The intervention included creating resident led teams that included teaching faculty attending and members of the hospital quality improvement committee. These teams were educated on the American Heart Association (AHA) cardiac monitoring guidelines [2]. The AHA guidelines were also distributed to the house-staff teams at the beginning of the intervention period and throughout the process. The intervention also included daily hospital telemetry census review of the house-staff covered patients maintained on tele monitoring. The indications for cardiac monitoring were reviewed on a daily basis. Teaching attending were then updated with the status of the patients on tele monitoring during the daily communication huddle. A discussion was then held to consider removing telemetry if there was no clinical indication per the AHA guidelines. Daily discussion around telemetry status during multidisciplinary rounds was also an important component of the intervention.

2.2. Data Collected

The data collected from each timeframe included: internal medicine house-staff census (the intervention group), internal medicine community providers census (the control group), number of patients on telemetry in the intervention group, number of patients on telemetry in the control group and the number of days each patient was maintained on telemetry (duration of telemetry) for the intervention and the control group. The following were calculated for the intervention and the control group: 1) percentage of patients on telemetry, 2) average duration of telemetry per patient (days), 3) number of patients maintained on telemetry for more than 48 hours. Data regarding the number of Rapid Response Team (RRT) calls for the pre- and post-intervention period were recorded. Total cost of telemetry care per day was also recorded. Information regarding costs was obtained from the financial administrator.

2.3. Primary Outcome

The primary outcome was to compare the percentage of patients on telemetry, number of days per patient on telemetry and number of patients maintained on telemetry for more than 48 hours before and after the intervention, stratified by the two groups (i.e. intervention group vs. control group).

2.4. Secondary Outcome

The secondary outcome was to compare the number of rapid responses in the pre and post intervention periods. Total costs of telemetry were also compared between the pre- and post-intervention period in the intervention group.

2.5. Statistical Analysis

Institutional review board (IRB) approval was obtained for this study. All study procedures were carried out in accordance with Declaration of Helsinki regarding research involving human subjects. Descriptive statistics were reported; Student's t-test was used to compare means for parametric data and Wilcoxon rank-sum test for non-parametric data. Stata 15 (College Station, TX) was used for analysis.

Table 1. *Telemetry project resident responsibilities.*

1.	Deliver education on telemetry AHA guidelines to all residents and teaching attending during beginning of intervention period and daily as requested.
2.	Daily review of house-staff telemetry census
3.	Daily review of telemetry indications for continuous monitoring
4.	Resident led notifications and recommendations for telemetry status for house-staff covered patients.
5.	Data collection of telemetry census, telemetry days and patients on telemetry for > 48 hours.

3. Results

On average, there were 34 patients that occupied a tele bed on a daily basis during the pre-intervention phase in the intervention group (i.e. house-staff covered patients) (Table 2). This was reduced to 25 patients/day maintained on telemetry in the post intervention period ($p<0.001$). The 34-patients/day on telemetry yielded 3,060 telemetry days during the pre-intervention period. Similarly, the 25-patients/day telemetry census in the intervention group yielded 2,250 during the post-intervention period. Overall,

the resident led intervention program resulted in 810 fewer days on telemetry in the intervention group (9 less patients on telemetry/day). On the other hand, in the control group (i.e. non-house-staff covered services) there were 115 and 118 patients that were maintained on telemetry/day in the pre- and post-intervention period, respectively. This yielded 10,350 and 10,620 tele days in the pre- and post-intervention periods, respectively.

The intervention resulted in a 22% relative decrease in the percentage of patients on telemetry in the intervention group (pre-intervention=44.6% vs. post-intervention=35%; p<0.0001) (Table 2). In contrast, the control group did not demonstrate a clinically meaningful change between the two study time periods (pre-intervention period=44.1% to post intervention period=45%; p <.0001).

The intervention also resulted in a 49% relative decrease in the average number of days that patients were maintained on telemetry in the intervention group (pre-intervention=5.7 vs. post-intervention=2.9; p< 0.001) (Figure 1).

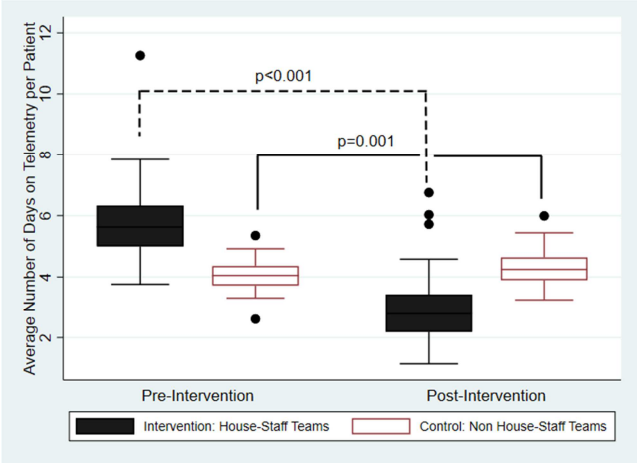

Figure 1. *Box and Whisker plot showing the average number of days that patients were kept on telemetry monitoring, stratified by service: Intervention (house-staff) vs. control (non-house-staff) showing that the rate dropped significantly by 49% for the intervention group. The intervention group saw a decrease in average number of days on telemetry from 5.7 days per patient to 2.9 days per patient. The nonintervention or control group saw the numbers increase from 4.0 days per patient to 4.3 days per patient.*

By comparison, in the control group this parameter remained unchanged in a clinically meaningful way (pre-intervention period=4.0 vs. post-intervention period=4.3; p=0.001).

In the intervention group, the number of patients maintained on telemetry for more than 48 hours decreased by 56% (pre-intervention=22.5 patients/day vs. post-intervention=9.9 patients/day; p<0.0001) (Figure 2). In contrast, in the control group, the number of patients maintained on telemetry for more than 48 hours increased significantly from 55.8 patients/day (pre-intervention period) to 61.3 patients/day (post-intervention period), (p= 0.0003) (Figure 2).

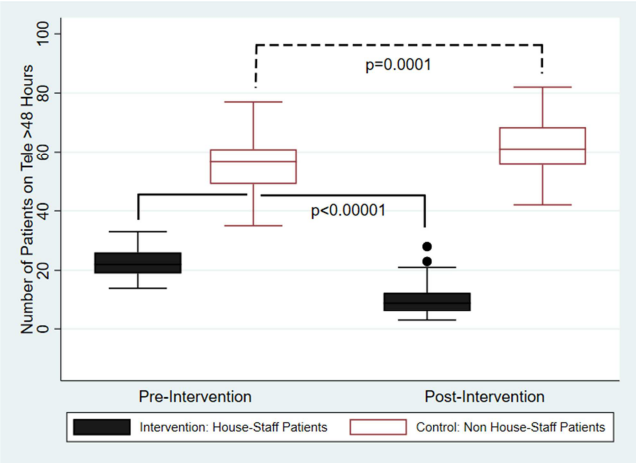

Figure 2. *Box and Whisker plot showing, among all patients on each service, the percentage who were maintained on telemetry monitoring for > 48 hours, stratified by service: Intervention (house-staff) vs. control (non-house-staff) showing that the rate dropped significantly by 56% for the intervention group. The intervention group saw a decrease from 22.5 patients per day to 9.9 patients per day. During the same period, the control group increased from 55.8 patients per day to 61.3 patients per day.*

Finally, the number of rapid responses (RR) did not reveal a change between pre- and post-intervention period (pre-intervention RR = 114/month vs. post-intervention = 108/month).

The average incremental payment for a telemetry bed versus a general medical-surgical bed in our institution was found to be $904.50, reflecting the cost of increased nursing intensity, monitor technicians, equipment and maintenance. This translates into a daily saving of $8,140.50 per day during the intervention period (9 patients/day X $904.50/day) and total saving during the study of $732,645 (810 days saved X $904.50/day).

Table 2. *Telemetry utilization during pre and post intervention period.*

	House-Staff			Non-House-Staff		
	Pre	**Post**	**P Value**	**Pre**	**Post**	**P Value**
Average Census (patients)	76	73		261	262	
Average Telemetry Census	34	25	P<0.001	115	118	P=0.028
Percentage of patients on telemetry	44.6%	35%	P<.0001	44.1%	45%	<.0001

4. Limitations

Our intervention team was limited to house-staff patients. We were not able to involve nursing staff, telemetry technicians and other multidisciplinary team members, which could have created a more significant impact. Our study was also limited by the fact that we were not able to impact telemetry orders upon admission. Dressler's approach of intervening at EOS and hardwiring AHA guidelines can be

very effective in bypassing this limitation [8].

5. Discussion

This study demonstrates that a resident led intervention program can have a major impact in reducing the inappropriate use of telemetry. In the house-staff covered patients, an overall reduction of 22% in the number of patients maintained on telemetry, a reduction of 49% in the total days on telemetry and a reduction of 56% in the number patients on tele monitoring for more than 48 hours were all statistically significant and clinically meaningful. Additionally, on average the resident led intervention freed up 9 tele beds on a daily basis (810 for the 90 day post intervention study phase). These are all desirable outcomes as reduction in total duration of telemetry has been shown to improve patient flow and decrease length of stay [9]. In their report, Patel et al have raised serious concerns that resident teams and their attending physicians might not be aware of telemetry indications and current telemetry status of patients [5]. Our study demonstrates that by creating resident led teams and interventions that raise awareness (Table 1), these concerns can be successfully addressed to decrease the inappropriate use of scarce hospital resources.

Multiple investigators have demonstrated a reduction in telemetry utilization by using various approaches [8, 11-14]. By hardwiring AHA guidelines into their electronic ordering system (EOS), Dressler et al observed a 43% reduction in weekly number of telemetry orders (before implementation of AHA guidelines=1032.3±32.1 [mean±SD] vs. after implementation of AHA guidelines=593.2±21.3 [mean±SD]) [8]. In addition, the duration of telemetry fell by 47% (before implementation of AHA guidelines=57.8±2.4 (mean±SD) hours vs. after implementation of AHA guidelines=30.9±0.9 (mean±SD) hours). Similarly, Rizvi et al focused on the notification for renewal of telemetry after 48 hours and caused a significant reduction in duration of telemetry from 3.61 to 2.7 days [12]. Our approach concentrated on residents to reduce an inappropriate use of telemetry and produced clinically meaningful results cited above. In addition, this strategy resulted in engaging residents and presented an opportunity to be directly involved in the understanding of quality and performance improvement projects. Their impact on the success of this program underscores the importance of active house-staff participation in this value-based care and "choosing wisely" era.

At least one study has examined the impact of financial reward on the use of telemetry [9]. In addition to the education, providers were given financial incentive ($2000) resulting in a 22% reduction in telemetry-related costs [9]. However, it is worth mentioning that the utility and long-term efficacy of financial incentives has been called into question recently and is a topic of an ongoing debate [15]. Neither Dressler nor our center used any financial incentive [8]. Yet, both caused a significant reduction in telemetry use as well as costs of care. While financial incentives can be important, residents focused on purpose, ownership and communication were the key success factors in our study.

Undoubtedly, the use of telemetry is associated with increased costs [8]. In this context, the inappropriate use of telemetry directly challenges the tenets of value-based care and "choosing wisely" [1]. Dressler documented a 3-fold decline in telemetry costs (before implementation of AHA guidelines = $18,971 vs. after implementation of AHA guidelines = $5772) [8]. Our cost analysis included the difference between occupying a tele- and a semi-private room. While there is some variation in reimbursement among different payers, the average incremental payment for a telemetry bed versus a general medical-surgical bed in our institution is $904.50, reflecting the cost of increased nursing intensity, monitor technicians, equipment and maintenance. This translates into a daily saving of $8,140.50 per day during the intervention period (9 patients/day X $904.50/day) and total saving during the study of $732,645 (810 days saved X $904.50/day). If sustained, we would expect annual savings of $2,930,580. In addition, and difficult to quantitate, the system would reap additional benefits from improvements in patient flow and consequently a decrease in Emergency Department boarding and patients who leave without treatment (LWOT). The over $700,000.00 saved during the 90-day post intervention phase was a significant achievement for the intervention group. It is important to mention that cost benefits were realized without compromising safety. Indeed, our results revealed that the number of rapid response calls did not increase in the post intervention period. These findings on safety are consistent with those reported by others [6, 8-10, 13].

6. Conclusion

Improving quality does not always require more financial commitment. In fact, this study demonstrated that by including medical residents, a relatively simple and organized approach can have a significantly positive impact on improving quality and at the same time reducing costs of medical care. The success of our telemetry project demonstrates that a focus on multidisciplinary collaboration is important in creating a change in healthcare delivery. Residents are an integral component of hospitals and their meaningful inclusion is crucial for a cost effective, high value health care system. We suggest that resident can be given leadership and ownership opportunities to partake in quality and performance improvement projects in an impactful way. Their alignment with hospitals and practicing physicians is critically important to deliver value-based care.

Statement of Ethics

The authors have no ethical conflicts to disclose.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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