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Improving Value by Reducing Unnecessary Telemetry and Urinary Catheter Utilization in Hospitalized Patients

Overuse of hospital medicine resources is a pervasive issue that is linked to adverse outcomes and increased costs.[1,2] Overutilization, defined as "the provision of medical services that are more likely to cause harm than good",[1] is increasingly recognized as a problem that both clinicians and healthcare systems have to contend with. The extent of overutilization is exemplified in a 2010 Institute of Medicine (now known as the National Academy of Medicine) report that estimated that the annual excess cost from healthcare waste in the United States was $765 billion, with approximately $210 billion in unnecessary services or procedures.[3]

Two resources in particular, urinary catheters and non-intensive care (ICU) telemetry monitoring have been highlighted by the Society of Hospital Medicine (SHM) and the American Board of Internal Medicine's Choosing Wisely campaign as resources that physicians should think twice about utilizing.[4] For instance, the use of urinary catheters for incontinence or inconvenience without proper indication or specified duration of use is associated with catheter-associated urinary tract infections (CAUTIs)—the most frequently occurring health care–acquired infection.[5,6] Similarly, non-ICU telemetry monitoring has been shown to be of limited benefit in low-risk cardiac patients, with inappropriate use leading to increased costs of care, false-positive signaling, and downstream testing and unnecessary interventions.[7-9] Because of these issues, the SHM Choosing Wisely guidelines specifically suggest that hospitals develop, maintain, and promulgate procedures that would decrease the use of such resources.

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Although these recommendations are salient, enacting interventions that symbiotically work with practitioners, compliment their workflow, and are easily implementable and universally applicable has been difficult. Because studies suggest clinicians are not aware which patients have an indwelling urinary catheter or are on telemetry,[10,11] we aimed to use a "silent" decision support tool embedded within the electronic health record (EHR) along with adjunct educational reminders to optimize the use of both urinary catheters and non-ICU telemetry monitoring.

METHODS

This project was a product of an institutional Choosing Wisely initiative meant to foster implementable ideas that could potentially decrease waste and improve the quality of patient care.[12] The project was selected by a committee whose members have expertise in research methods and delivery science. The Culture, Oversight, Systems Change, Training framework was used to guide creation and implementation for this value improvement intervention.[13]

Project Design and Setting

We designed and inserted a "silent" indicator on the electronic patient list that signaled an active telemetry or urinary catheter order for each patient (**Figure 1**), embedded in the hospital's EHR (Epic, Verona, Wisc). The indicator was specifically designed to allow for rapid visual review and reassessment for continued need for telemetry or a urinary catheter. Clicking on the indicator directed the user to a "manage orders" screen, allowing the provider to immediately cancel the order if they should deem it unnecessary. The indicator was universally placed within all 5 internal medicine teaching services, as well as the 4 non-teaching hospital medicine services at a large, urban, academic medical center located in Chicago, Ill. Additionally, we ensured that the indicator was present on the printed patient list—a common resource used by physicians at our institution.

At the start of each 2-week rotation (defined as transitioning attending physicians), the American Heart Association guidelines for telemetry use,[9] the SHM Choosing Wisely recommendations, and a notification of the new

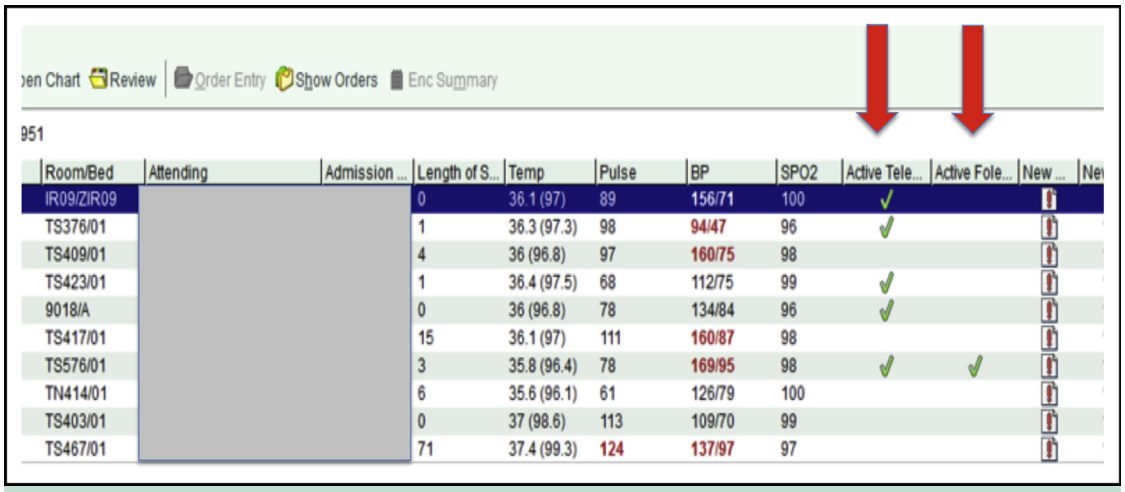

Figure 1 Electronic indicator on patient list screen within Epic Electronic Health Record. Check marks indicate active telemetry and urinary catheter orders. ©2017 Epic Systems Corporation.

indicator were e-mailed to house staff and attending physicians. Additionally, 2 1-hour presentations were given at the initiation of the intervention (March) and at the halfway point (June) of data acquisition. These 2 recommendations were chosen because they easily lent themselves to the idea of a "silent" notification, were verifiable through the EHR, and avoided the case-by-case nuances that might exist with the other 3 SHM Choosing Wisely recommendations.

Data Analysis

We used a single interrupted time series analysis, a quasi-experimental design used to estimate longitudinal effects of time-delineated interventions, to estimate changes in utilization of telemetry and urinary catheters. We analyzed 2 parameters of the time series, the level (y-intercept) and the trend (slope) for both the pre- and postintervention segments.[14] The preintervention period was defined as 9 months before the intervention, whereas the post-intervention period was 6 months (March-August 2016). Patients with hospital stays >14 days, who had an ICU stay, or who had a catheter on admission were excluded from analysis, because these patients are more likely to require these resources and thus did not fit the SHM Choosing Wisely recommendations. Telemetry and catheter utilization were obtained through the EHR and analyzed with R, v3.3.2 (R Foundation, Vienna). This project was formally determined to be quality improvement, not human subjects research, and was therefore not overseen by the institutional review board, per institutional policy.

RESULTS

In total, 1213 and 7901 patients with a urinary catheter and telemetry were assessed, respectively. Assuming pre-intervention trends, 29% fewer catheters were ordered (8.5% vs 6.0%; $P < .05$) (Figure 2A), though no statistical change in catheter duration was found (41.5 vs 35.8 hours; $P > .05$) (Figure 2B). We estimate that this resulted in a total of 226 patient days without a urinary catheter during the intervention period.

Although no difference in the percentage of patients who received telemetry orders was seen, a significant decrease in the ordering trend for telemetry ($P < .01$) (Figure 3A) was noted after implementation. Additionally, patients receiving telemetry orders spent 18% less time on telemetry (42.5 vs 34.9 hours; $P < .01$) (Figure 3B). We estimate that this resulted in a total of 1181 patient days without telemetry during the intervention period, a reduction of 25%.

There were no differences in the number of rapid responses or code blues between the preintervention and post-intervention periods. The average monthly case mix index (CMI) increased from a median of 3.10 (interquartile range [IQR], 2.8-3.2) to 3.60 (IQR, 3.2-4.8) ($P = .015$) and 1.38 (IQR, 1.35-1.45) to 1.46 (IQR, 1.45-1.50) ($P = .02$) for patients who received a catheter or telemetry order, respectively. There was no difference in CMI for the overall hospital patient population in the pre- and postintervention periods (1.65 [IQR, 1.57-1.73] vs 1.66 [IQR, 1.64-1.73], $P = .34$). In subgroup analysis, neither the non-teaching hospitalists nor the internal medicine teaching services were found to have lower rates of utilization of either resource.

DISCUSSION

In implementing a "silent" decision-support tool to remind providers of 2 SHM Choosing Wisely recommendations, we demonstrated a trend toward fewer telemetry orders, less time spent on telemetry, fewer urinary catheters ordered, and a more selective utilization of these resources in sicker patients (ie, higher CMI). Moreover, by focusing on 2 separate high-yield resources that are distinctive and often not directly clinically related, this single quality improvement project was able to expand its impact to 2 different patient populations.

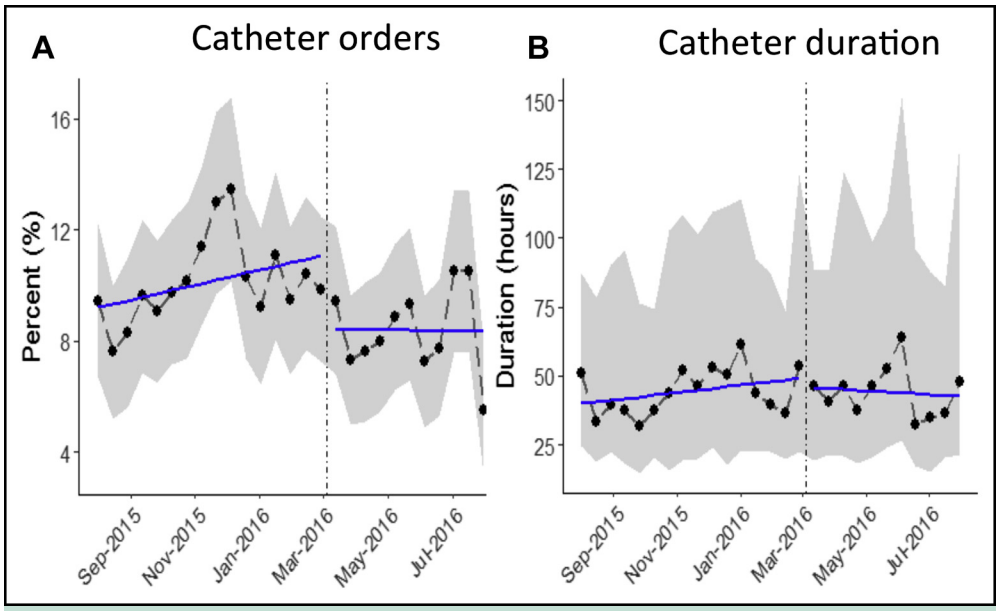

Figure 2 Trend in urinary catheters ordered and duration of use, March 2015-August 2016. Vertical line indicates implementation of initiative. (**A**) Catheter orders; dotted line are observed findings, solid line is modeled, grey scale is 95% confidence interval. (**B**) Catheter duration; dotted line are observed findings, solid line is modeled, grey scale represents Q1 to Q3 interquartile range.

We hypothesize that these effects were due to several factors. First, by improving clinicians' cognitive awareness of the use of these resources, the intervention forced practitioners to reassess the utility of their use whenever they viewed their patient list. This is illustrated by the fact that although no significant decrease in the number of telemetry orders was seen, we did find a significant decrease in the time on telemetry, suggesting that the indicator's effect is more prominent after hospital admission (ie, when it is being viewed most). Urinary catheter duration showed a similar but nonsignificant trend. Second, by improving and expediting access to the "manage orders" screen, we

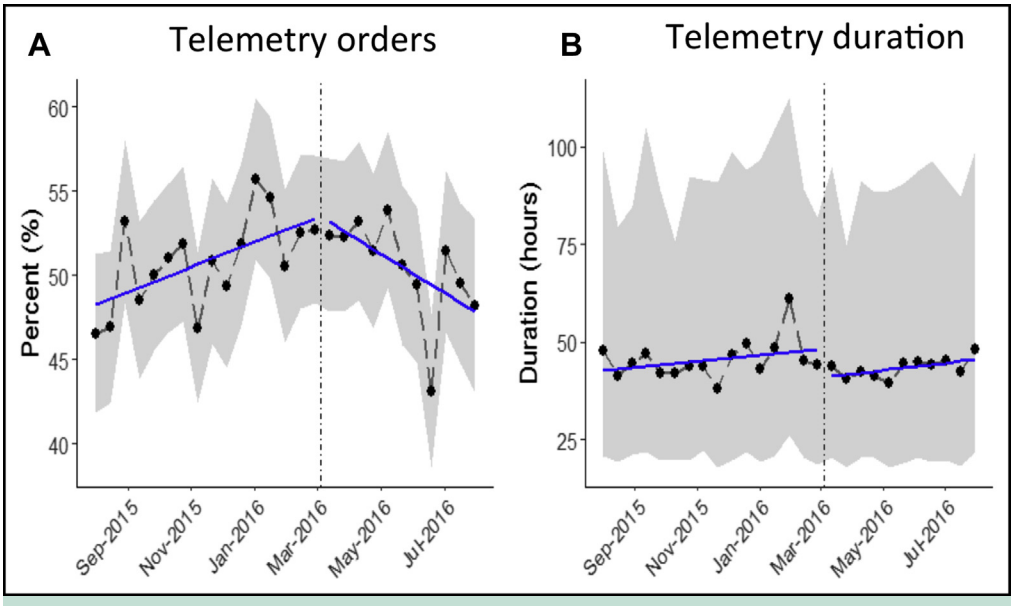

Figure 3 Trend in telemetry orders and duration of use, March 2015-August 2016. Vertical line indicates implementation of initiative. (**A**) Telemetry orders; dotted line are observed findings, solid line is modeled, grey scale is 95% confidence interval. (**B**) Telemetry duration; dotted line are observed findings, solid line is modeled, grey scale represents Q1 to Q3 interquartile range.

subsequently decreased the barrier to de-implementation. Third, by ensuring that the information was also available on the printed patient list, this extended the influence of the intervention from the EHR to the clinical environment, thus expanding and integrating the primary intervention into daily workflow. Each of these mechanisms works to inform and expedite high-value care in a manner that is non-obtrusive and respectful of physician workflow.

Although targeting telemetry and urinary catheters use is not a new idea, this quality improvement intervention remains novel in several ways. For example, instead of focusing large-scale efforts on a single intervention, and thus a small, specific patient population, we expanded our focus to include 2, SHM Choosing Wisely recommendations so as to broaden its scope and improve care for a larger percentage of the patient population. This approach also allowed us to further validate the treatment effect, because the independent nature of the use of each resource further suggests that the findings are less likely artifact, and more likely to be due to our intervention. Additionally, given the issue of alarm fatigue[15,16] and its adverse effects on the user experience and patient safety, we chose to utilize a "silent" notification that would subtly signal to the user that resources were being utilized. This method attempted to avoid reminder fatigue and the subsequent rapid clinician dismissal that may follow.[17]

Previous studies have explored the benefits of improving utilization of both telemetry and urinary catheter and act to highlight the benefits associated with more stringent use of these resources. For instance, Svec et al[18] found that a multipronged intervention to improve appropriate use of telemetry led to reduced hospital length of stay and cost. A developed and robust field of urinary catheter interventions has consistently shown that catheter restriction protocols and clinical reminders to prompt the removal of urinary catheters can lead to reduced utilization, fewer CAUTI, and decreased costs.[6]

The project does have limitations. First, as a single-hospital initiative, generalizability may be limited; however, we highlight that the intervention involved a simple modification to one of the most widely used EHRs in the United States.[19] Second, although education alone is unlikely to cause sustained practice change,[20] it remains unclear whether the benefits were due to education or the electronic indicator. Regardless, both components are easily exportable to other institutions and environments. Third, although we did not assess CAUTI rates, previous work has shown that decreased use of urinary catheters is associated with decreased CAUTIs.[6] Fourth, the postintervention period was only 6 months, with one of the metrics (telemetry duration) indicating a return to preintervention levels, which may question the durability and sustainability of the intervention. Finally, although we did not perform a cost-effectiveness analysis, prior work has suggested significant savings with decreased use of both telemetry and urinary catheters.[6,9,18,21-23] Although unlike several of these studies, which were labor intensive or provided financial incentives that may negate any savings,[6,18,21] this project had little to no financial costs associated with its implementation or maintenance, which may suggest similar cost-saving effects.

CONCLUSION

This project demonstrates that the placement of a "silent" indicator within the EHR in addition to adjunct educational reminders can decrease the use of low value resources without any negative impact on patient care. The ease of implementation and generalizability of this intervention make this an attractive and easy intervention to export to other institutions. Future work that aims to optimize the use of hospital medicine resources could expand upon the principles of "silent" indicators, work-flow integration, and decreasing barriers to implementation that were utilized in this intervention.

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