Prospective Evaluation of a Multifaceted Intervention to Improve Outcomes in Intensive Care: The Promoting Respect and Ongoing Safety Through Patient Engagement Communication and Technology Study*

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Objectives: Studies comprehensively assessing interventions to improve team communication and to engage patients and care partners in ICUs are lacking. This study examines the effectiveness of a patient-centered care and engagement program in the medical ICU.

Design: Prospective intervention study.

Setting: Medical ICUs at large tertiary care center.

Patients: Two thousand one hundred five patient admissions (1,030 before and 1,075 during the intervention) from July 2013 to May 2014 and July 2014 to May 2015.

Interventions: Structured patient-centered care and engagement training program and web-based technology including ICU safety checklist, tools to develop shared care plan, and messaging platform. Patient and care partner access to online portal to view health information, participate in the care plan, and communicate with providers.

Measurements and Main Results: Primary outcome was aggregate adverse event rate. Secondary outcomes included patient and care partner satisfaction, care plan concordance, and resource utilization. We included 2,105 patient admissions, (1,030 baseline and 1,075 during intervention periods). The aggregate rate of adverse events fell 29%, from 59.0 per 1,000 patient days (95% CI, 51.8–67.2) to 41.9 per 1,000 patient days (95% CI, 36.3–48.3; $p < 0.001$), during the intervention period. Satisfaction improved markedly from an overall hospital rating of 71.8 (95% CI, 61.1–82.6) to 93.3 (95% CI, 88.2–98.4; $p < 0.001$) for patients and from 84.3 (95% CI, 81.3–87.3) to 90.0 (95% CI, 88.1–91.9; $p < 0.001$) for care partners. No change in care plan concordance or resource utilization.

***See also p. 1424.**

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Conclusions: Implementation of a structured team communication and patient engagement program in the ICU was associated with a reduction in adverse events and improved patient and care partner satisfaction. (*Crit Care Med* 2017; 45:e806–e813)

Key Words: checklist; medical errors; medical informatics; patient-centered care; patient engagement

ICU hospitalizations can be frightening and may have long-term consequences for patients including posttraumatic stress disorder (1). Furthermore, patients cared for in ICUs are particularly vulnerable to adverse events (AEs) (2). Although checklists have been found to be effective in reducing specific types of AEs in critical care, preventable AEs still frequently occur (2). Recent literature suggests that the ICU experience could be safer if care were more patient-centered and if patients could be engaged more effectively (3).

Active partnerships among health professionals, patients, and families can improve the quality, safety, and delivery of healthcare (4). Evidence indicates that patient engagement affects self-management, treatment adherence, satisfaction, and healthcare costs (5). However, intensive care is a difficult environment in which to engage patients—because most patients are critically ill and many are incapacitated (6). Yet, patients and families want to be actively involved, and many patients have a "care partner." Care partners can be a family member or friend who works with the patient to engage with the healthcare team even when the patient is not physically able. A care partner helps with care navigation including communication with providers, asking for clarity around complex issues, letting the team know about patient preferences, and facilitating follow-up on unresolved issues (7).

Operationally, patient engagement in the ICU may include participation in rounds, communication about values and goals, and protection of individual respect and dignity (4). Interprofessional communication related to the patient's goals and care plan occurs during patient rounds. Previous studies focusing on provider members of the care team indicate that a standardized interprofessional rounding structure facilitated by electronic health record (EHR) data and checklist tools is associated with improved adherence with the standard of care, patient outcomes, and provider satisfaction (8, 9). Earlier work at our institution highlights the importance of engaging with patients and care partners to identify goals of care and to jointly assess the effectiveness of treatment in meeting goals and restoring life (10). However, the use of health information technology (IT) to support integrated patient-centered model of team communication in the ICU, characterized by shared checklists, health information, and goals across team members has not been reported. Patient portals are another way to promote engagement and enhance patient-provider partnerships (11). The type of information included in patient portals varies markedly by site (12). Portal content can range from EHR data (laboratory results, medications, problems) to patient education and self-management tools. With patient permission, care partners can access their portal. Outpatient portals have been shown to improve patient-provider communication and patient satisfaction (13). However, the use of portals in hospitals, especially in the ICU, has been limited (14).

Despite evidence that health IT and patient-centered care can improve safety and outcomes, little research has assessed interventions that leverage health IT to improve team communication while engaging patients and care partners in the ICU. Therefore, we designed an intervention and conducted a prospective study to assess the effect of a patient-centered care and engagement program enabled by health IT on care delivered in the ICU.

METHODS

This prospective pre-post study was conducted in two medical ICUs (MICUs) at a large tertiary care center from July 1, 2013, through June 8, 2014 (baseline period), and from July 1, 2014, through May 29, 2015 (intervention period). Implementation of the intervention, including training, was completed by June 30, 2014. The institutional review board approved the study protocol.

Study Unit Descriptions and Patient Eligibility

Both MICUs operate using a "closed" model, whereby the critical care team maintained responsibility for all patients on the unit (15). The ICU staff (physicians and nurses) rotated on both units. Each unit had a physician team comprised of an attending physician, critical care fellows, interns, and residents. There was 24-hour attending-level coverage for each unit, and physician and nursing staff worked 12-hour shifts. Residents rotated in 2-week blocks. Physician and nurse staffing ratios and work schedules were the same during the 11 months of baseline and intervention data collection periods. Any patient 18 years old or older and admitted to the ICU for 24 hours or longer was eligible to participate.

Preintervention Period

Attending physicians, fellows, residents, and nurses participated in daily rounds and used existing paper (safety checklist, nursing flow sheet, care plan) and electronic tools (computerized provider order entry, laboratory/test results, medication administration record). There was no preexisting standardized approach for team communication or patient engagement. During rounds, the team verbally reviewed a paper-based safety checklist that included prompts for standard safety elements (16).

Intervention

The Promoting Respect and Ongoing Safety through Patient Engagement Communication and Technology (PROSPECT) intervention was a systems-based patient-centered care and engagement program that was introduced to providers (physicians and nurses) to enhance their responsiveness to patients and care partners (**Fig. 1**; **Appendix A**, Supplemental Digital Content 1, http://links.lww.com/CCM/C605). The intervention consisted of the following components: 1) a 60-minute training session that introduced the Patient Satisf*Active* Model that included structured patient-centered care training to enhance

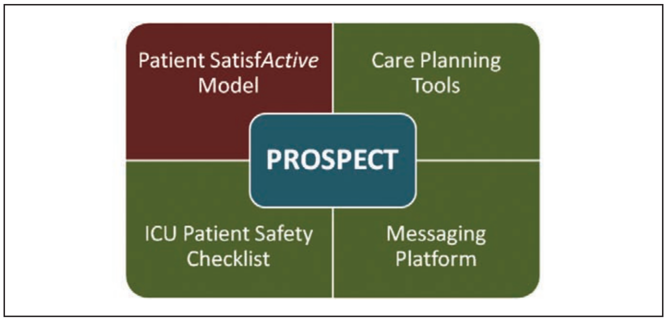

Figure 1. The PROSPECT (Promoting Respect and Ongoing Safety through Patient Engagement Communication and Technology) intervention included 1) a nontechnical structured patient-centered care and engagement model (Patient Satisf*Active* Model) and 2) a web-based technology to facilitate communication and to engage patients/care partners with providers in their care plan. Providers (physicians, nurses) received structured patient-centered care and engagement training using the Patient Satisf*Active* Model and a web-based patient-centered toolkit comprised of an ICU safety checklist, shared patient and provider care planning and messaging platform. Providers accessed the toolkit via mobile and desktop devices. Patients/care partners were given access to a portal via iPads (Apple, Cupertino, CA) to view health information, participate in the care plan, and communicate with providers. Detailed information about the PROSPECT intervention components is included in Appendix A (Supplemental Digital Content 1, http://links.lww.com/CCM/C605).

responsiveness to the needs, concerns, and expectations of patients and care partners and interactive training on the use of a web-based toolkit to facilitate team communication and patient engagement (**Appendixes B1**, Supplemental Digital Content 2, http://links.lww.com/CCM/C606; **Appendix B2**, Supplemental Digital Content 3, http://links.lww.com/CCM/C607). 2) A web-based toolkit including a) an ICU safety checklist prepopulated with real-time EHR data, b) shared patient and provider care planning tools, and c) a messaging platform for communicating with providers and patients. The web-based toolkit was used by providers for all patients during the intervention period. In addition, all patients and care partners received the Patient Satisf*Active* Model in which nurses asked patients at admission, during each shift, and at time of ICU discharge about their perceived needs, concerns, and expectations. Patient wishes were routinely discussed by the team during interprofessional rounds and were integrated into the daily care plan as needed. Patients capable of providing informed consent (or proxy) were eligible to use the patient portal accessible on hospital-issued iPads (iPad Air; Apple, Cupertino, CA) available at every patient's bedside to view personal health information, to participate in developing the care plan, and to communicate with providers. Research assistants approached eligible patients (or proxy) to participate in using the portal. The informed consent process was extensive (i.e., a 10-page informed consent and access authorization form). Once enrolled, patients/proxies were shown how to use the portal and could access the portal throughout their stay in the MICU.

Main Outcome Measures

The primary outcome was the aggregate rate per 1,000 patient days of selected AEs, defined as failed processes of care and/or unintended consequences of medical care that can lead to patient harm (2, 17). To avoid outcomes ascertainment bias, we included only those AEs that are routinely reported within established organizational surveillance processes (and therefore captured and vetted independently of the study team): falls, pressure ulcers, catheter-associated urinary tract infections, central catheter-associated bloodstream infections, and ventilator-associated events. Secondary outcomes were patient and care partner satisfaction, care plan concordance (e.g., agreement on the care plan) between the patient and providers, and healthcare utilization. Secondary outcome data were collected in REDCap (18) using organizational reporting systems. Validated survey instruments were administered with verbal consent to a randomly selected subsample of patients (19) care partners (20), and providers to assess care plan concordance (21, 22). Patient satisfaction data were collected through telephone using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) (23) survey 6 weeks after discharge. Hospitalized patients (or a care partner) as well as their bedside nurse and a physician were interviewed at least 48 hours into admission using a validated care plan concordance assessment tool (22) modified to include the patient's key recovery goal (24). Outcome measure definitions, surveys, and data sources are included in **Table 1**. Process measures included the number of patients/care partners who provided informed consent to use the patient portal.

Statistical Analysis

Based on previously reported AE rates (2) and the effect of communication interventions (8) in critical care, we hypothesized that there would be a 28% decrease in the rate of AEs in the baseline period to the intervention group. We estimated that a total sample size of 1,800 would provide a statistical power of 80% to detect this decrease, at a two-sided significance level of 5% using a propensity-adjusted two sample Poisson test (30).

Demographic characteristics for patient admissions are described using proportions for dichotomous variables and means for continuous variables. Demographics are compared before and during the intervention using Pearson's chi-square test for dichotomous variables and Wilcoxon rank-sum tests for continuous variables. We used weighted propensity score methods to account for differences in observed participant characteristics between the baseline and intervention periods. For the patient/care partner surveys, the following demographics are adjusted: gender, age, education, race, self-reported health status (patient), and relationship to patient (care partner). Using the weighted propensity score method, each patient was weighted by the inverse propensity of being in the baseline or intervention period in all analyses. The propensity was estimated using logistic regression with potential confounders as covariates. Weighted propensity score methods control for confounding factors better than regression models alone (31). The robust SEs used with the weighted propensity score approach also accounted for repeated measures (stays) on the same patient (patients who had multiple stays during the study). AE rates were compared using Poisson regression, with a dichotomous covariate for before versus after the

TABLE 1. Promoting Respect and Ongoing Safety Through Patient Engagement Communication and Technology Outcome Measures, Timing, Data Sources, and Methods

Measure	Timing	Data Source	Method/Tool
Aggregate adverse events. Failed processes of care and/or unintended consequences of medical care that can lead to patient harm. Includes: 1) Blood stream infections (25) 2) Ventilator-associated event (26) 3) Catheter-associated urinary tract infections (27) 4) Falls (28) 5) Pressure ulcers (28)	Ongoing (independent of Promoting Respect and Ongoing Safety through Patient Engagement Communication and Technology Project)	BWH Quality and Infection Control Departments	Used standard definitions (25–28) for measures that involved data routinely collected by the BWH Quality and Infection Control Departments (external to study team) and events submitted by clinicians
Care partner (family) reported experience and satisfaction	Prior to transfer from ICU	In-person survey with care partner/family by research staff	FS-ICU (20) composite score based on average of all 24 items (FS-ICU total, satisfaction with care, and satisfaction with decision-making) FS-ICU includes a 5-point Likert scale 1 (excellent) to 5 (poor). All items give response option "not applicable." 1) A random sample of care partners 2) Sample size based on power calculation
Patient reported experience and satisfaction	45 d after discharge from hospital	Telephone Survey of Patients by research staff	Hospital Consumer Assessment of Healthcare Providers and Systems survey (29) "Top Box Score" e.g., Patients who gave their hospital a rating of 9 or 10 on a scale from 0 (lowest) to 10 (highest) 1) Random sample of care partners 2) Sample size based on power calculation
Care plan concordance: The degree of agreement of patient's overall goal for hospitalization between patient/care partner, responding physician, and nurse.	At time of transfer (ICU)	Patients, care partner/family, physician, nurse interviews	Interview based survey based on Haberle (24) 1) Random sample of care partners 2) Sample size based on power calculation
Healthcare utilization (proxy)	Post discharge	BWH administrative data	Administrative report 1) Length of stay 2) 30-d readmission

BWH = Brigham and Women's Hospital, FS-ICU = Family Satisfaction-ICU.

intervention period. Patient and care partner experience were compared using robust linear regression for ordinal outcomes. Mean global care plan concordance scores were compared in the baseline and intervention periods using generalized estimating equations to account for multiple ratings on the same patient (32). Healthcare utilization was compared before versus intervention periods using exponential regression.

For the main outcome of the rate of AEs, we also performed an interrupted time series (33) (segmented Poisson regression) analysis to determine whether the changes in rates pre versus post were due to changes in the trends pre versus post, and not the same downward secular trend that continued from pre to post. As a sensitivity analysis, weighted estimating equations were used to account for missing data (34). All analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC).

Role of the Funding source

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RESULTS

Patient Admissions

A total of 2,105 patient admissions (*n* = 1,030 during baseline, *n* = 1,075 during intervention) were reviewed for AEs. Demographics were similar during baseline and intervention, but patients admitted in the intervention period were less likely to be white and more often had Medicaid insurance (**Table 2**).

TABLE 2. **Baseline Characteristics of Patients at the Time of the Enrollment**

Characteristic	Baseline	Intervention	*p*	Portal Users	Nonusers	*p*
No. of unique admissions	1,030	1,075		194	881	0.03
White	730 (70.87%)	717 (66.70%)	0.04	146 (75.26%)	571 (64.81%)	
Black	145 (14.08)	152 (14.14)		19 (9.79)	133 (15.10)	
Hispanic	74 (7.18)	91 (8.47)		11 (5.67)	80 (9.08)	
Other	17 (1.65)	37 (3.44)		3 (1.55)	34(3.86)	
Unknown	64 (6.21)	78 (7.26)		15 (7.73)	63 (7.15)	
Medicaid	75 (7.30)	129 (12.01)	0.003	17 (8.76)	112 (12.73)	0.06
Medicare	508 (49.46)	497 (46.28)		82 (42.27)	415 (47.16)	
Private	408 (39.73)	398 (37.06)		89 (45.88)	309 (35.11)	
Self pay	14 (1.36)	22 (2.05)		3(1.55)	19 (2.16)	
Other	22 (2.14)	28 (2.61)		3(1.55)	25 (2.84)	
Missing	3	1		0	1	
Female	505 (49.03)	535(49.77)	0.73	104 (53.61)	431 (48.92)	0.24
Mean age (SD)	60.27 (17.22)	59.92 (17.05)	0.47	58.13 (16.27)	60.31 (17.21)	0.09
Mean Charlson score (SD)[a]	3.86 (2.67)	4.03 (2.66)	0.08	4.11 (2.69)	4.02 (2.66)	0.67
Mean of median income based on zip code (SD)	69,850.52 (24,784.07)	68,484.54 (25,377.82)	0.10	71,076.23 (23,390.38)	67,919.30 (25,769.10)	0.07
Average total hospital length of stay per patient admission	12.90 (13.96)	13.32 (15.01)	0.99	18.60 (18.07)	12.16 (14.00)	< 0.0001

[a] Higher Charlson score indicates greater risk of 10-yr mortality.

Patient portal enrollment was 18% of all patient admissions during the intervention period and was higher among patients who were white, younger, and those with private insurance.

Provider Participants

All 219 physicians and 92 nurses working in the MICU during the intervention period were trained and participated in the PROSPECT intervention. The majority of provider participants (91% physicians and 79.3% nurses) worked in the MICU during the baseline period.

Outcomes

There was a 29% relative reduction in the aggregate rate of AEs, from 59.0 per 1,000 patient days (95% CI, 51.8–67.2) to 41.9 per 1,000 patient days (95% CI, 36.3–48.3), *p* value of less than 0.001 (**Table 3**) and pre-post, *p* value equals to 0.049 for the interrupted time series. This translates into a reduction of 17.1 AEs per 1,000 patient days. Also, results were very similar using weighted estimating equations to account for missing data.

The percent of patients who reported a top box score (9 or 10 on the 0–10 HCAHPS question [19]) for their overall hospital rating significantly improved from 71.8 (95% CI, 61.1–82.6) to 93.3 (95% CI, 88.2–98.4), *p* value of less than 0.001. Care partner satisfaction with the ICU experience also improved significantly from 84.3 (95% CI, 81.3–87.3) to 90.0 (95% CI, 88.1–91.9), *p* value of less than 0.001. Care team concordance with patient's care plan and resource utilization was unchanged.

DISCUSSION

We implemented a multifaceted intervention in the ICU and observed improved outcomes with about a one-third lower rate of AEs, as well as large improvements in satisfaction scores for MICU patients and their care partners. These improvements are important, as the ICU is an inherently risky place where both patients and care partners can feel alienated. As with any complex intervention, we cannot determine which component had the greatest impact, but we believe the improvements are related to multiple factors. We attribute the marked improvement in AEs and satisfaction to use of the safety checklist tool and our efforts at engaging patients, care partners, and care team members via the various intervention components. The intervention was directly integrated into multidisciplinary rounds with the intent of improving communication among patients and providers. Daily use of the web-based safety checklist enabled review of the critical care safety elements; patient goals, preferences, and priorities were systematically addressed. This review translated into routinely focusing on patients' concerns, updating the care plan, and reviewing adherence (or rationale for nonadherence) with standard critical care safety elements (Appendix A, Supplemental Digital Content 1, http://links.lww.com/CCM/C605) such as catheter days and mobility status (3). All frontline

TABLE 3. Primary Outcome: Aggregate Adverse Events Comprised of Catheter-Associated Urinary Tract Infection, Bloodstream Infection, Ventilator-Associated Events, Falls, and Pressure Ulcers

Main Outcome: Medical Adverse Events			
Total No. of Adverse Events (Rate per 1,000 Patient Days) (95% CI)			
Medical Adverse Event Type	**Before ($n = 997$ Admissions)**	**After ($n = 1,050$ Admissions)**	p
All adverse events	59.0 (51.8–67.2)	41.9 (36.3–48.3)	< 0.001
Catheter-associated urinary tract infection	3.9 (2.5–5.9)	1.1 (0.5–2.4)	0.005
Bloodstream infection	1.6 (0.8–3.2)	0.9 (0.4-2.2)	0.36
Ventilator-associated events	10.1 (7.9–13.1)	9.5 (7.2–12.6)	0.75
Falls	0.5 (0.2–1.6)	0.5 (0.2–1.6)	0.93
Pressure ulcers	42.9 (36.4–50.6)	29.9 (24.9–35.8)	0.003

Weighted propensity-adjusted results, adjusted for gender, age, race, insurance, Charlson comorbidity index, and median income based of patient's zip code.

TABLE 4. Secondary Outcomes Comprised of Patient Experience, Care Partner Experience, Global Concordance With Patient's Overall Care Plan, and Resource Utilization

Secondary Outcomes	Before	After	p
Patient experience			
Overall hospital rating Hospital Consumer Assessment of Healthcare Providers and Systems Top Box Score, range 0–100	71.8% ($n = 53$; 61.1–82.5)	93.3% ($n = 58$; 88.2–98.4)	< 0.001
Care partner experience			
Overall Satisfaction Family Satisfaction-ICU (20) Total Score, range 0–100	84.3% ($n = 106$; 81.3–87.3)	90.0% ($n = 156$; 88.1–91.9)	< 0.001
Global concordance with patient's overall care plan			
Mean Global Concordance Score (95% CI)	59% ($n = 169$; 55.3–62.7)	59.1% ($n = 93$; 54.5–63.8)	0.96
Resource utilization			
Mean (median) length of stay (d) medical ICU [range]	4.9 (2) [1–108], $n = 881$	5.0 (2) [1–115], $n = 904$	0.61
30-d hospital readmission (95% CI)	0.188 ($n = 924$; 0.16–0.21)	0.184 ($n = 960$; 0.16–0.21)	0.82

Weighted propensity-adjusted results, adjusted for gender, age, education, race, self-reported health status (patient), and relationship to patient (care partner).

clinicians actively engaged patients and care partners in addressing their needs, concerns, and expectations regarding the care plan throughout their MICU stay. This enhanced patient and care partner engagement activity occurred regardless of a use of the patient portal. Although the portal enrollment rate was modest, the tools and workflows offered patients a method of communicating a primary goal for hospitalization, submitting questions regarding the care plan, and viewing their medical problems and goals of care. The aim of these interventions was to shift the clinical paradigm from providers alone determining "What is the matter?" to discovering "What matters to you?" (35), as well as to working collaboratively with patients. Because MICU patients may be too ill to actively participate, a partnership between the critical care team and care partners is often needed to provide patient-centered care in the ICU setting (4).

Under value-based purchasing, hospital payments are now tied to quality metrics including AEs and patient experience (36). For that reason, the improvements we found in patient outcomes are important. Other studies have demonstrated improvements in satisfaction, clinical outcomes, and business metrics associated with patient-centered care in acute care settings but not previously in the ICU (37–39). Despite concerted efforts geared toward improvement, these outcomes are often mixed (40). The improvement in AE rate was driven by catheter-associated urinary tract infections and pressure ulcers. Both of these AEs are fairly frequent and they had relatively high rates in the preintervention period (41, 42), making it easier to demonstrate improvement. Although the other outcomes (with the exception of patient falls) trended in the right direction, the changes were not significant.

Bloodstream infections, ventilator associates events, and falls at baseline were at or below benchmark in the preintervention period (41, 42). Given that these are rare events, there may have been insufficient time in the trial to demonstrate statistical significance.

We found that improving care plan concordance in critical care was challenging. Others have noted that the interventions used to simultaneously treat and diagnose critically ill patients often change rapidly to maintain clinical stability (43). Because the patient portal was specifically configured to facilitate patient-provider messaging and improve patient-provider concordance for key elements of the care plan, the lack of improvement we observed may be explained by the limited use of this component.

Study Limitations

This study has a number of limitations. First, it was conducted in two MICUs within a single tertiary care center. Although the results may not be generalizable to other institutions, the fact that the technology is based on standard critical care checklists and was used within typical ICU workflows, it may be generalizable to other ICUs that have adopted these best practices and that have a governance structure in place that allows for engaging staff in quality improvement efforts (8, 9). Second, as a prospective pre-post study, the presence of other factors to minimize AE could have affected our results. However, a post hoc interrupted time series analysis to control for temporal factors indicated significant decreases in AEs during the intervention period. Third, because our intervention was not blinded, providers who implemented it were aware of the study and the outcome measures. To reduce this potential source of bias, we did not collect or validate any of the AE data but instead used the hospital's standard AE reporting system. There were key ICU outcomes, such as death and readmission after transfer out of the ICU, that we elected not to include in the aggregate AE measure. Fourth, because a portion of our patient record was paper-based, we were unable to automatically calculate Acute Physiology and Chronic Health Evaluation scores (44). We did calculate Charlson (45). Charlson does not substitute for an illness severity measure, but it is a marker of long-term outcomes after hospital discharge. Fifth, patients were exposed to the intervention and increased clinician attention associated with use of the intervention. It is unclear whether it was the multiple part intervention or the increased clinician attention that contributed most to outcomes. Finally, the limited enrollment of patient portal users and the fact that we were unable to track whether patients allowed additional care partners (or enrolled care partners allowed patients) to access the portal under their login prevented us from more robustly evaluating the impact of this technology on patient (or care partner) activation. Further, as noted in **Table 4**, patient portal users had longer lengths of stay. We attribute this to the fact that patients who had more complicated health issues were in the ICU longer. An unplanned corollary was that longer lengths of stay provided more opportunity for staff to enroll patients or care partners and provided them more opportunity to use the portal.

Clinical Implications

To our knowledge, this study is the largest to date to evaluate a patient-centered care model including provider and patient use of web-based technology within a hospital setting (14) and likely the only one targeting portal use in MICU patients and care partners. Providers did routinely use the Patient Satisf*Active* Model, the electronic checklist, and care planning tools. Patient engagement and satisfaction improved significantly, despite low enrollment in use of the patient portal. Barriers to portal use (46) included the physical status of patients, emotional status of care partners, relatively brief lengths of stay, and the onerous tasks associated with subject enrollment. Streamlining enrollment procedures and providing portal access to care partners outside of the hospital could engage geographically distant, but willing care partners. One meaningful use provision that has generated debate is requiring a specific proportion of patients to use a portal (47). Activating patients to use portals is complex; the true impact of this technology will only be realized after barriers are overcome. Additional work is needed to identify methods and tools to establish shared accountability and to negotiate responsibility with patients and care partners.

CONCLUSIONS

In this study, the use of structured patient-centered care training and web-based technology to engage patients and care partners was associated with decreased rates of selected AEs and improved satisfaction. Further study is needed to determine whether a similar program evaluated over a longer period and in other critical care settings would be as effective.

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