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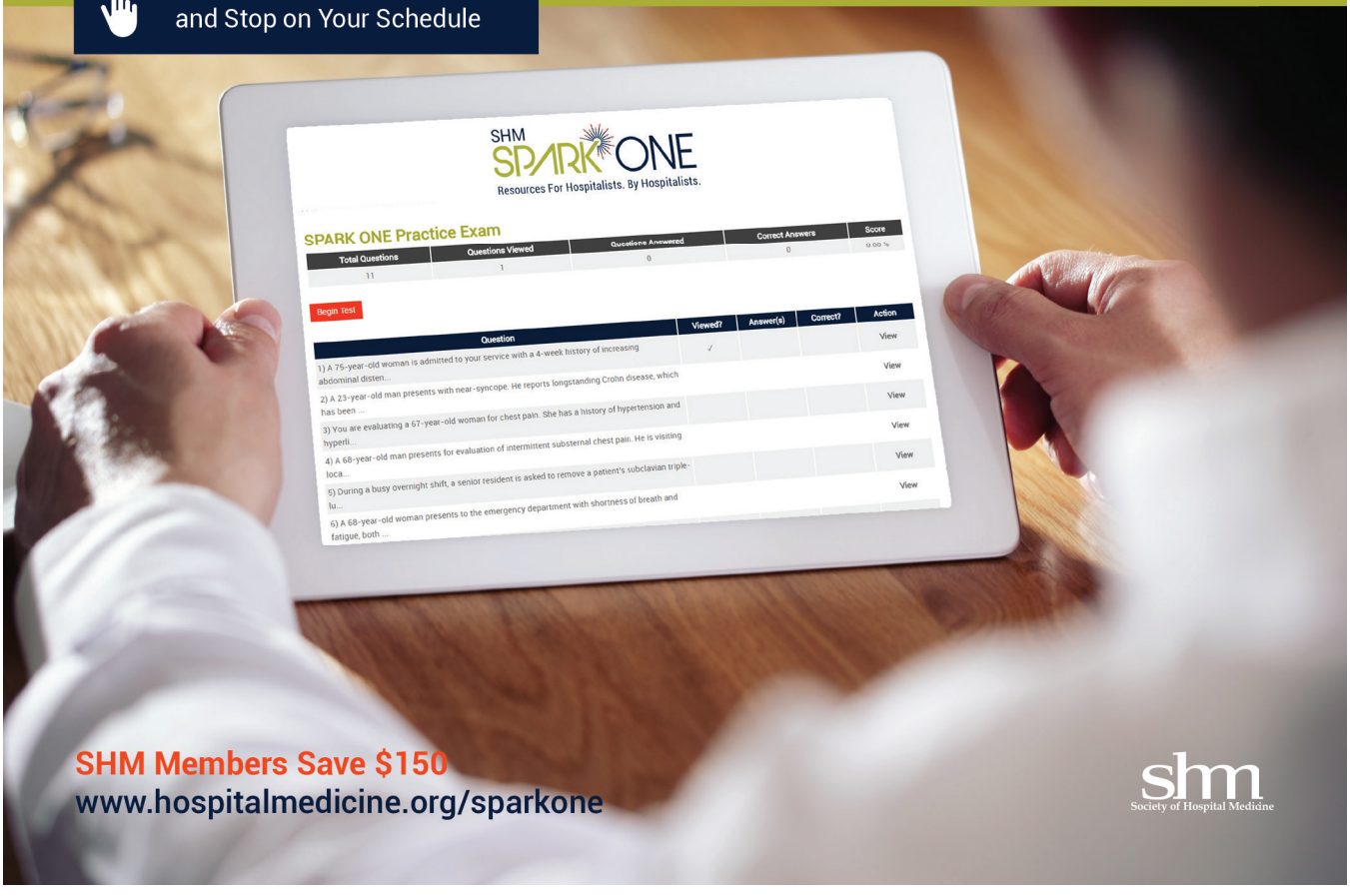

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REVIEW

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The Impact of Bedside Interdisciplinary Rounds on Length of Stay and Complications

Andrew S. Dunn, MD, MPH[1*], Maria Reyna, MD[1], Brian Radbill, MD[2], Michael Parides, PhD, MS, MPhil[3], Claudia Colgan[4], Tobi Osio[5], Ari Benson, MD[6], Nicole Brown, MD[6], Joy Cambe[6], Margo Zwerling, MPH[6], Natalia Egorova, PhD, MPH[3], Harold Kaplan, MD[3]

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BACKGROUND: Communication among team members within hospitals is typically fragmented. Bedside interdisciplinary rounds (IDR) have the potential to improve communication and outcomes through enhanced structure and patient engagement.

OBJECTIVE: To decrease length of stay (LOS) and complications through the transformation of daily IDR to a bedside model.

DESIGN: Controlled trial.

SETTING: 2 geographic areas of a medical unit using a clinical microsystem structure.

PATIENTS: 2005 hospitalizations over a 12-month period.

INTERVENTIONS: A bedside model (mobile interdisciplinary care rounds [MICRO]) was developed. MICRO featured a defined structure, scripting, patient engagement, and a patient safety checklist.

MEASUREMENTS: The primary outcomes were clinical deterioration (composite of death, transfer to a higher level of care, or development of a hospital-acquired complication) and length of stay (LOS). Patient safety culture and perceptions of bedside interdisciplinary rounding were assessed pre- and postimplementation.

RESULTS: There was no difference in LOS (6.6 vs 7.0 days, $P = 0.17$, for the MICRO and control groups, respectively) or clinical deterioration (7.7% vs 9.3%, $P = 0.46$). LOS was reduced for patients transferred to the study unit (10.4 vs 14.0 days, $P = 0.02$, for the MICRO and control groups, respectively). Nurses and hospitalists gave significantly higher scores for patient safety climate and the efficiency of rounds after implementation of the MICRO model.

LIMITATIONS: The trial was performed at a single hospital.

CONCLUSIONS: Bedside IDR did not reduce overall LOS or clinical deterioration. Future studies should examine whether comprehensive transformation of medical units, including co-leadership, geographic cohorting of teams, and bedside interdisciplinary rounding, improves clinical outcomes compared to units without these features. *Journal of Hospital Medicine* 2017;12:137-142. © 2017 Society of Hospital Medicine

The care of hospitalized patients requires practitioners from multiple disciplines to assess and communicate the patient's status in a dynamic manner during hospitalization. Although optimal teamwork is needed for patient care to be delivered reliably and efficiently, care within hospitals is typically delivered in a fragmented manner.[1] A bedside model for daily interdisciplinary rounds (IDR) has been proposed as a method to provide a structured process and engage all team members in a patient-centered, system-of-care delivery.[2] Specific advantages of convening rounds in the presence of the patient include the ability to directly assess care (eg, presence of a potentially unnecessary urinary catheter), patient engagement in key aspects of their care and disposition, and an increased opportunity for team members to develop a shared understanding of the patient's views and needs.

Implementing dramatic changes to the workflow of multiple disciplines will require rigorous evidence to support a concerted effort from leadership and buy-in from stakeholders at the front line of patient care. Despite the urgency for evidence, there has been little investigation of this strategy. A systematic review[3] identified 30 studies published between 1998 and 2013 addressing interdisciplinary interventions on medical wards, none of which examined a bedside IDR model. In a study performed after the period assessed by the systematic review, Stein et al[4] described the restructuring of a medical ward as an accountable care unit (ACU), which included a bedside model for rounds by the interdisciplinary team. The change was associated with decreased mortality and length of stay (LOS), although the study did not isolate the impact of rounds or use a concurrent control group and presented aggregate rather than patient-level outcomes. The lack of convincing data may be a reason bedside rounds are not widely employed by hospitals. To provide high-quality evidence, we performed a large, prospective controlled trial comparing a structured bedside model (mobile interdisciplinary care rounds [MICRO]) with standard rounds.

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METHODS

This study took place at the Mount Sinai Hospital, which is a 1171-bed tertiary care academic medical center in New York City, New York. A nonteaching unit offered the ability to use a prospective controlled design. Patients were assigned to the north and the south wings of the unit in a quasi-randomized manner, rather than based on diagnosis or acuity. We transformed IDR to a bedside model on the north side of the unit (MICRO group), while the south side of the unit continued using standard conference room-based IDR (control group). The north and south sides of the unit contain 17 and 14 beds, respectively. During the study period, nurses and hospitalists cared for patients on both sides of the study unit, although on any given day were assigned only patients on 1 side of the unit. The unit uses a clinical microsystem model, which has been defined as "a group of clinicians and staff working together with a shared clinical purpose to provide care for a population of patients," and has a defined set of characteristics associated with high performance.[5,6] Our microsystem model has incorporated features as described by Stein's ACU model,[4] including co-leadership by a hospitalist and a nurse manager, geographic assignment of patients to teams, and unit-level data reports. One hospitalist is assigned geographically to each area of the unit in a 2- to 4-week rotation. Coverage of the unit does not include house staff; patients are primarily assigned to hospitalists working with nurse practitioners. Patients were enrolled prospectively during their initial IDR by a research coordinator. Patient-level data and outcomes were collected prospectively by a research coordinator who attended IDR on the intervention and the control sides of the study unit daily.

Inclusion Criteria

All patients admitted to the medicine service on the study unit were eligible. Patients were greater than 18 years and admitted for an acute medical condition. Patients admitted to another unit and later transferred to the study unit were enrolled at the time of transfer. Patients could be included more than once if hospitalized on the study unit on more than 1 occasion. Most patients were covered by hospitalists, although patients covered by private physicians were included. Patients from other departments, including family medicine, are uncommonly admitted to the unit and were excluded. Patients were also excluded if they were admitted and discharged over the same weekend, because the MICRO rounds occur during weekdays and there was no opportunity to offer the intervention on Saturdays and Sundays.

MICRO Intervention

Interdisciplinary rounds occurred daily at 10:00 AM for the control group and at 10:30 AM for the MICRO group, and were attended by the hospitalist caring for the majority of patients on the unit, staff nurses, and the unit medical director, nurse manager, social worker, and case manager. Rounds on the control unit focused on the plan of care and disposition but did not follow any set structure and were typically 25 to 30 minutes in duration.

The MICRO rounds occurred at the bedside and followed a structured script (Appendix 1) that was designed to limit discussion of each patient to 3 minutes or less, and included speaking roles for the hospitalist, nurse, and social worker. For private physicians, the nurse practitioner assigned to the patient performed the role of the hospitalist. Rounds were expected to be approximately 50 minutes in duration. Patients were further engaged by asking for their main goal for the day. A patient safety checklist was reviewed. Initially, this task was performed by the nurse manager, who did not verbalize the items unless a deficiency was noted. After 6 months' experience, this responsibility was given to the staff nurse, who reviewed the checklist verbally as part of the bedside script. Patients were seen daily, including those being discharged later that same day.

Staff and Clinician Education

We developed and implemented a curriculum based on a modified version of the Agency for Healthcare Research and Quality's TeamStepps® program to ensure that all team members were provided with the basic principles of communication within the healthcare setting. The curriculum consisted of interactive didactics on essential elements of teamwork, including team structure, communication, situation monitoring, and mutual support, as well as the purpose and structure of the MICRO model. The curriculum was delivered to nurses at 3 monthly staff meetings on the study unit and to hospitalists during 3 hospital medicine grand rounds over a 3-month period. Nurses and physicians providing care on both geographic areas of the study unit received the education program because no group of practitioners was designated to only 1 geographic area.

OUTCOMES

Primary and Secondary Outcomes

The primary outcomes were clinical deterioration (CD) and length of stay. Clinical deterioration was a composite outcome defined a priori as death; escalation of care (ie, transfer to an intensive care unit, intermediate care unit, or teaching unit); or a hospital-acquired complication (ie, venous thromboembolism, fall, stage III-IV pressure ulcer, catheter-associated urinary tract infection, central-line associated bloodstream infection, or *Clostridium difficile*-associated diarrhea). The LOS was calculated as the mean LOS with outliers excluded (outliers defined as having a LOS 100 days or longer or 2.5 or more standard deviations from the expected LOS).

Process metrics on IDR, such as the duration of rounds, attendance by members of the interdisciplinary team, the percentage of patients discussed, or the effectiveness of communication, were not collected. We assessed patient satisfaction based on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey.

Patient Safety Culture Survey

To assess the impact on the perceptions of patient safety, we administered the Agency for Healthcare Research and Quality (AHRQ) Hospital Survey on Patient Safety Culture to all staff and clinicians working on both sides of the study unit immediately before and 12 months after implementation of the MICRO model. Results are reported for the AHRQ dimensions that were most relevant to the MICRO intervention: "teamwork within units," "overall perceptions of safety," "communication," "openness," "overall patient safety grade," and "handoffs and transitions." The survey represents pre- and post-comparison. All nurses and hospitalists on both the MICRO and control sides of the study unit had received the TeamStepps curriculum and participated in MICRO rounds by the time of the postintervention survey. We added 3 questions specifically assessing the perception of the efficiency and effectiveness of IDR. Postintervention respondents reflected on their overall impression of IDR, which included their experiences on both sides of the unit, because no group of nurses or hospitalists was exposed only to the MICRO side or the control side of the unit. Responses to survey questions were recorded on a 5-point Likert scale (from "strongly disagree" to "strongly agree" for opinion questions; and "never," rarely," sometimes," "most of the time," and "always" for frequency questions) and given a score from 1 to 5. The question asking for an overall grade for patient safety was scored from 1 to 5 points corresponding to letter grade choices F, D, C, B, A.

Statistical Analysis

The sample size was based on the estimate of the baseline rate of the primary outcome of CD and the projected decrease by the MICRO intervention. A study using the Global Trigger Tool developed by the Institute for Healthcare Improvement provided a best estimate of 16% as the baseline rate for CD.[7] A total of 2000 hospitalizations were planned to be included to have a power of at least 80% to detect a 25% reduction in the annual incidence of CD with a 2-tailed type I error rate of 0.05. Comparisons of dichotomous event rates were made using chi square tests at a 2-tailed level for significance of 0.05. The LOS was analyzed using the nonparametric median test and multivariable regression analysis. We used a generalized linear model with gamma distribution and log link for all analyses of LOS, where LOS was the outcome variable, and intervention vs. control unit type was the predictor variable. Age, sex, race, payer, case mix, and comorbidities defined with the Elixhauser algorithm were used as covariates.[8] We used multivariable logistic regression for analysis of CD, where the dependent variable was CD. Predictor variables included intervention, patient age, sex, race, payer, case mix and comorbidities. Patient satisfaction data were compared using the chi square test. The Student t test for dependent means was used to analyze the patient safety culture survey data.

The study protocol was submitted to the Icahn Mount Sinai School of Medicine's institutional review board and determined to be exempt from full review.

RESULTS

A total of 2005 hospitalizations were included over the 12-month study period, consisting of 1089 hospitalizations in the MICRO group and 916 in the control group. Bedside and standard IDR were completed daily, Monday through Friday without exception. The demographic characteristics and comorbidities were similar for the 2 groups (Table). Hospitalizations of patients who were initially admitted to another unit and subsequently transferred to the study unit accounted for 11.1% of hospitalizations.

Risk-adjusted LOS was similar for the groups (6.6 vs 7.0 days, $P = 0.17$, for the MICRO and control groups, respectively). On subgroup analysis, a reduction in LOS was noted for patients transferred to the study unit (10.4 vs 14.0 days, $P = 0.02$, for the MICRO and control groups, respectively). The LOS was unchanged for patients admitted directly to the study unit (6.0 vs 5.8 days, $P = 0.93$). There was no difference in the incidence of clinical deterioration for the MICRO or control groups (7.7% vs 9.3%, odds ratio, 0.89; 95% confidence interval, 0.61-1.22, $P = 0.46$).

The finding of a LOS benefit for the MICRO group limited to patients transferred to the study unit prompted a comparison of patients transferred to the study unit and patients directly admitted to the study unit from the emergency department (Appendix 2). Compared to patients admitted directly to the study unit, patients transferred to the study unit were more likely to have Medicaid or no insurance, more likely to be discharged to a facility, had longer LOS, and were more likely to experience CD.

Patient Satisfaction

There were 175 and 140 responses to the HCAHPS survey for the MICRO and the control groups, respectively. Patients in the MICRO group were more likely to report that "doctors, nurses, or other hospital staff talk with you about whether you would have the help you needed when you left the hospital" (88% vs 78%, $P = 0.01$). Responses for all other HCAHPS items were similar for the 2 groups.

Clinician/Staff Survey

The response rate was 96% (30 nurses and 17 hospitalists) pre-intervention and 100% (30 nurses and 22 hospitalists) postintervention. Hospitalists and nurses gave significantly higher scores for the dimensions "teamwork within units," "overall perception of patient safety," and "patient safety grade" on the postintervention survey compared to the pre-intervention survey (Figure 1). Hospitalists and nurses rated the efficiency of IDR and the ability of IDR to identify safety issues higher on the postintervention survey compared to the pre-intervention survey (Figure 2).

DISCUSSION

We transformed daily IDR from a standard conference room model to a structured bedside model with scripted roles, and performed a rigorous comparison using patient-level data. Our finding that transforming daily IDR from a standard con-

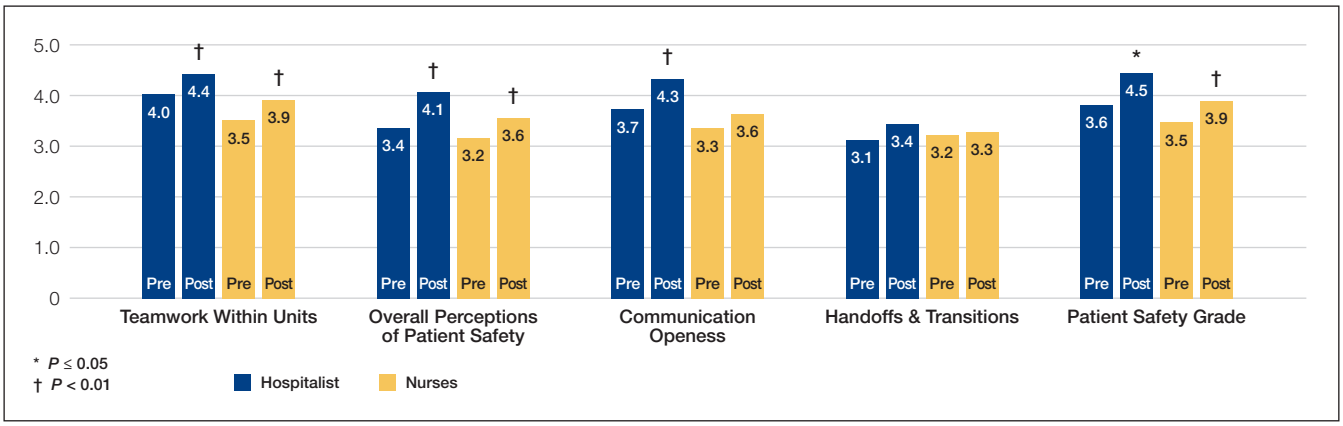

FIG. 1. Patient safety culture dimensions.

NOTE: Abbreviations: pre, pre-intervention survey; post, postintervention survey.

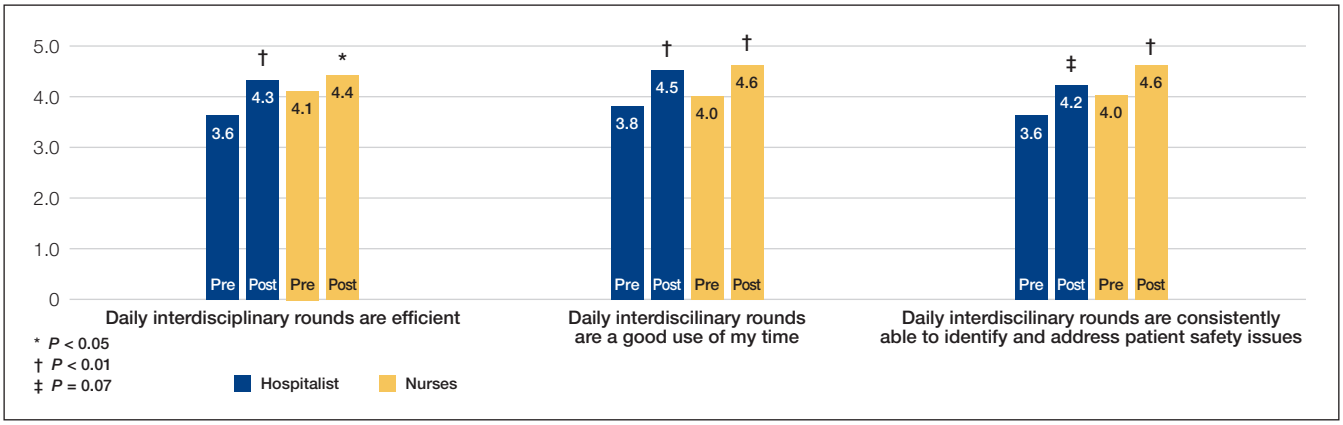

FIG. 2. Hospitalist and nurse perceptions of interdisciplinary rounds.

NOTE: Abbreviations: pre, pre-intervention survey; post, postintervention survey.

ference room model to a bedside model did not significantly reduce LOS suggests either that the model is ineffective or needs to be incorporated into more comprehensive efforts to improve clinical outcomes. Studies suggest that bedside rounding can improve outcomes when implemented in the context of comprehensive restructuring of patient care.[4,9] Stein et al.[4] have described the reorganization of a medical ward as an "accountable care unit." The ACU model included daily IDRs at the bedside, as well as geographic-based teams, co-leadership by a hospitalist and nurse manager, and unit-level reporting. Although no definitive conclusions can be drawn based on their descriptive report, transformation of the unit was associated with reduced LOS and mortality. Similarly, Kara et al.[9] found that the number of elements of an "accountable care team" model implemented by each unit was associated with greater reductions in LOS and cost. In contrast, our findings of a lack of an effect are consistent with a recent cluster-randomized trial by O'Leary et al,[10] which found that implementation of patient-centered bedside rounds did not improve patient satisfaction or perceptions of shared decision-making compared to units using a model of structured IDRs in a conference room setting. It is notable that the control groups in both the O'Leary trial[10] and this study did not represent usual care, because these groups featured localization of the clinical teams and high-quality IDR. In our trial, it is plausible that the control side of the unit was functioning at a high level, which would have decreased our ability to further improve outcomes. Whether restructuring unit processes, including implementation of bedside IDR, improves care compared to usual care without these processes is unknown.

We found that the MICRO intervention significantly decreased LOS compared to the control group for patients transferred to the study unit. This analysis was exploratory and the finding was unexpected. Patients were transferred to the study unit from units of higher acuity, and were more likely to have Medicaid or no insurance and be discharged to facilities rather than home, suggesting that these patients had substantial disposition challenges. It is plausible that this is the population for which bedside IDRs may have the greatest impact. This was a secondary analysis, however, and should be considered as hypothesis-generating for future investigations.

Although the impact on outcomes of bedside IDRs is un-

TABLE. Demographics and Patient Characteristics

	MICRO Group (n = 1089)	Control Group (n = 916)	*P* value
Age (y) (SD)	63.1 (20.2)	62.8 (19.8)	0.69
Gender, n (%) female	625 (57.4)	535 (58.4)	0.65
Race, n (%)			0.45
Caucasian	315 (28.9)	244 (26.6)	
Black	350 (32.1)	316 (34.5)	
Asian	27 (2.5)	16 (1.8)	
Hispanic	306 (28.1)	266 (29.0)	
Other	80 (7.4)	64 (7.0)	
Unknown	11 (1.0)	10 (1.1)	
Insurance status, n (%)			
Medicaid	413 (37.9)	355 (38.8)	0.77
Medicare	405 (37.2)	337 (36.8)	
Commercial	249 (22.9)	212 (23.1)	
Uninsured	18 (1.7)	9 (1.0)	
Other	4 (0.4)	3 (0.3)	
Diabetes, n (%)	241 (22.1)	209 (22.8)	0.71
Hypertension, n (%)	473 (43.4)	375 (40.9)	0.26
Coronary artery disease, n (%)	241 (22.1)	191 (20.9)	0.49
Admitted initially to another unit, n (%)	116 (10.6)	102 (11.1)	0.60
Elixhauser comorbidity score, mean (SD)	5.22 (6.99)	5.43 (7.36)	0.51
Case mix			0.09
Infectious and parasitic diseases	248 (22.8)	259 (28.3)	
Endocrine disease	281 (25.8)	206 (22.5)	
Fluid and electrolytes	213 (19.6)	163 (17.8)	
Hematology	71 (6.5)	54 (5.9)	
Cancer	72 (6.6)	46 (5.0)	
Psychiatric disorders	55 (5.1)	54 (5.9)	
Diseases of the heart	6 (0.8)	6 (0.7)	
Other	143 (13.1)	128 (14.0)	

NOTE: Abbreviation: SD, standard deviation.

certain, potential benefits and practical barriers have been examined. Gonzalo et al.[11] surveyed inpatient physicians and nurses at a hospital employing bedside IDRs and found that the benefits ranked the highest were communication, coordination, and teamwork, and the lowest-ranked benefits were related to efficiency and outcomes. The 6 greatest barriers concerned the time required to complete bedside IDR. These results indicate that the time investiture by staff may be a barrier to widespread adoption. More modest changes, such as increasing the structure of standard conference room rounds, may improve care, although the data are mixed. O'Leary et al.[12] assessed the value of a structured approach in a conference room setting, which primarily entailed implementing a checklist for newly admitted patients, and found no difference in LOS. Follow-up studies by these investigators found mixed results on the ability of structured IDR to decrease the incidence of adverse events.[13,14]

The results of our AHRQ survey of patient safety culture found that several important aspects of teamwork and safety were perceived as improved by the intervention, including the "overall grade on patient safety." Other studies have similarly shown increases in teamwork and safety ratings through redesign of IDR. O'Leary et al.[12] surveyed residents and nurses on a unit that implemented a structured, conference room-based IDR and found that providers on the intervention unit rated the teamwork climate higher than providers on the control unit. Our finding that hospitalists and nurses gave higher ratings for IDR being "efficient" and "a good use of my time" on the postintervention survey than the pre-intervention survey suggests that initial concerns about the additional time commitment may be offset by gains in overall efficiency and in development of an environment of enhanced communication, teamwork, and safety.

This study has several limitations. First, the trial may have been underpowered to find small differences between the groups. The trends for decreased LOS and clinical deterioration in the MICRO group may suggest that bedside IDR can provide a small but clinically significant benefit that would

be statistically significant only in a larger trial. Second, patients were not randomized to the 2 groups. The impact is diminished, however, because the routine hospital process for assigning patients to the 2 areas in which the groups were located is random and based solely on bed availability. Third, nurses and hospitalists caring for patients in the control group likely experienced improved communication practices from the unit-wide TeamStepps education and from participating in the MICRO protocol when caring for patients on the intervention side of the unit. Fourth, we did not collect data on the effectiveness of communication and are unable to assess the fidelity with which the structured protocol was followed or whether interprofessional communication was fostered or hindered. Lastly, the study was implemented on a nonteaching unit at a single academic medical center. The protocol and the results may not be generalizable to other hospitals or units that include house staff.

In conclusion, transforming IDR from a conference room model to a bedside model did not reduce overall LOS or clinical deterioration on a unit using features of an ACU structure. Although several beneficial effects were noted, including a reduction in LOS for patients transferred to the study unit and higher ratings of the patient safety climate and efficiency of IDR, implementing bedside IDR in this setting has marginal benefit. Future studies should assess whether a comprehensive transformation of the inpatient model of care, including patient-centered bedside IDR, geographic cohorting of teams, and co-leadership, improves outcomes compared to models without these features.

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Standardized Attending Rounds to Improve the Patient Experience: A Pragmatic Cluster Randomized Controlled Trial

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BACKGROUND: At academic medical centers, attending rounds (AR) serve to coordinate patient care and educate trainees, yet variably involve patients.

OBJECTIVE: To determine the impact of standardized bedside AR on patient satisfaction with rounds.

DESIGN: Cluster randomized controlled trial.

SETTING: 500-bed urban, quaternary care hospital.

PATIENTS: 1200 patients admitted to the medicine service.

INTERVENTION: Teams in the intervention arm received training to adhere to 5 AR practices: 1) pre-rounds huddle; 2) bedside rounds; 3) nurse integration; 4) real-time order entry; 5) whiteboard updates. Control arm teams continued usual rounding practices.

MEASUREMENTS: Trained observers audited rounds to assess adherence to recommended AR practices and surveyed patients following AR. The primary outcome was patient satisfaction with AR. Secondary outcomes were perceived and actual AR duration, and attending and trainee satisfaction.

RESULTS: We observed 241 (70.1%) and 264 (76.7%) AR in the intervention and control arms, respectively, which included 1855 and 1903 patient rounding encounters. Using a 5-point Likert scale, patients in the intervention arm reported increased satisfaction with AR (4.49 vs 4.25; P = 0.01) and felt more cared for by their medicine team (4.54 vs 4.36; P = 0.03). Although the intervention shortened the duration of AR by 8 minutes on average (143 vs 151 minutes; P = 0.052), trainees perceived intervention AR as lasting longer and reported lower satisfaction with intervention AR.

CONCLUSIONS: Medicine teams can adopt a standardized, patient-centered, time-saving rounding model that leads to increased patient satisfaction with AR and the perception that patients are more cared for by their medicine team. *Journal of Hospital Medicine* 2017;12:143-149. © 2017 Society of Hospital Medicine

Patient experience has recently received heightened attention given evidence supporting an association between patient experience and quality of care,[1] and the coupling of patient satisfaction to reimbursement rates for Medicare patients.[2] Patient experience is often assessed through surveys of patient satisfaction, which correlates with patient perceptions of nurse and physician communication.[3] Teaching hospitals introduce variables that may impact communication, including the involvement of multiple levels of care providers and competing patient care vs. educational priorities. Patients admitted to teaching services express decreased satisfaction with coordination and overall care compared with patients on nonteaching services.[4]

Clinical supervision of trainees on teaching services is primarily achieved through attending rounds (AR), where patients' clinical presentations and management are discussed with an attending physician. Poor communication during AR may negatively affect the patient experience through inefficient care coordination among the inter-professional care team or through implementation of interventions without patients' knowledge or input.[5-11] Although patient engagement in rounds has been associated with higher patient satisfaction with rounds,[12-19] AR and case presentations often occur at a distance from the patient's bedside.[20,21] Furthermore, AR vary in the time allotted per patient and the extent of participation of nurses and other allied health professionals. Standardized bedside rounding processes have been shown to improve efficiency, decrease daily resident work hours,[22] and improve nurse-physician teamwork.[23]

Despite these benefits, recent prospective studies of bedside AR interventions have not improved patient satisfaction with rounds. One involved the implementation of interprofessional patient-centered bedside rounds on a nonteaching service,[24] while the other evaluated the impact of integrating athletic principles into multidisciplinary work rounds.[25] Work at our institution had sought to develop AR practice recommendations to foster an optimal patient experience, while maintaining provider workflow efficiency, facilitating interdisciplinary communication, and advancing trainee education.[26] Using these AR recommendations, we conducted a prospective randomized controlled trial to eval-

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uate the impact of implementing a standardized bedside AR model on patient satisfaction with rounds. We also assessed attending physician and trainee satisfaction with rounds, and perceived and actual AR duration.

METHODS

Setting and Participants

This trial was conducted on the internal medicine teaching service of the University of California San Francisco Medical Center from September 3, 2013 to November 27, 2013. The service is comprised of 8 teams, with a total average daily census of 80 to 90 patients. Teams are comprised of an attending physician, a senior resident (in the second or third year of residency training), 2 interns, and a third- and/or fourth-year medical student.

This trial, which was approved by the University of California, San Francisco Committee on Human Research (UCSF CHR) and was registered with ClinicalTrials.gov (NCT01931553), was classified under Quality Improvement and did not require informed consent of patients or providers.

Intervention Description

We conducted a cluster randomized trial to evaluate the impact of a bundled set of 5 AR practice recommendations, adapted from published work,[26] on patient experience, as well as on attending and trainee satisfaction: 1) huddling to establish the rounding schedule and priorities; 2) conducting bedside rounds; 3) integrating bedside nurses; 4) completing real-time order entry using bedside computers; 5) updating the whiteboard in each patient's room with care plan information.

At the beginning of each month, study investigators (Nader Najafi and Bradley Monash) led a 1.5-hour workshop to train attending physicians and trainees allocated to the intervention arm on the recommended AR practices. Participants also received informational handouts to be referenced during AR. Attending physicians and trainees randomized to the control arm continued usual rounding practices. Control teams were notified that there would be observers on rounds but were not informed of the study aims.

Randomization and Team Assignments

The medicine service was divided into 2 arms, each comprised of 4 teams. Using a coin flip, Cluster 1 (Teams A, B, C, and D) was randomized to the intervention, and Cluster 2 (Teams E, F, G, and H) was randomized to the control. This design was pragmatically chosen to ensure that 1 team from each arm would admit patients daily. Allocation concealment of attending physicians and trainees was not possible given the nature of the intervention. Patients were blinded to study arm allocation.

MEASURES AND OUTCOMES

Adherence to Practice Recommendations

Thirty premedical students served as volunteer AR auditors. Each auditor received orientation and training in data collection techniques during a single 2-hour workshop. The auditors, blinded to study arm allocation, independently observed morning AR during weekdays and recorded the completion of the following elements as a dichotomous (yes/no) outcome: pre-rounds huddle, participation of nurse in AR, real-time order entry, and whiteboard use. They recorded the duration of AR per day for each team (minutes) and the rounding model for each patient rounding encounter during AR (bedside, hallway, or card flip).[23] Bedside rounds were defined as presentation and discussion of the patient care plan in the presence of the patient. Hallway rounds were defined as presentation and discussion of the patient care plan partially outside the patient's room and partially in the presence of the patient. Card-flip rounds were defined as presentation and discussion of the patient care plan entirely outside of the patient's room without the team seeing the patient together. Two auditors simultaneously observed a random subset of patient-rounding encounters to evaluate inter-rater reliability, and the concordance between auditor observations was good (Pearson correlation = 0.66).[27]

Patient-Related Outcomes

The primary outcome was patient satisfaction with AR, assessed using a survey adapted from published work.[12,14,28,29] Patients were approached to complete the questionnaire after they had experienced at least 1 AR. Patients were excluded if they were non-English-speaking, unavailable (eg, off the unit for testing or treatment), in isolation, or had impaired mental status. For patients admitted multiple times during the study period, only the first questionnaire was used. Survey questions included patient involvement in decision-making, quality of communication between patient and medicine team, and the perception that the medicine team cared about the patient. Patients were asked to state their level of agreement with each item on a 5-point Likert scale. We obtained data on patient demographics from administrative datasets.

Healthcare Provider Outcomes

Attending physicians and trainees on service for at least 7 consecutive days were sent an electronic survey, adapted from published work.[25,30] Questions assessed satisfaction with AR, perceived value of bedside rounds, and extent of patient and nursing involvement. Level of agreement with each item was captured on a continuous scale; 0 = strongly disagree to 100 = strongly agree, or from 0 (far too little) to 100 (far too much), with 50 equating to "about right." Attending physicians and trainees were also asked to estimate the average duration of AR (in minutes).

Statistical Analyses

Analyses were blinded to study arm allocation and followed intention-to-treat principles. One attending physician crossed over from intervention to control arm; patient surveys associated with this attending (n = 4) were excluded to avoid contamination. No trainees crossed over.

Demographic and clinical characteristics of patients who

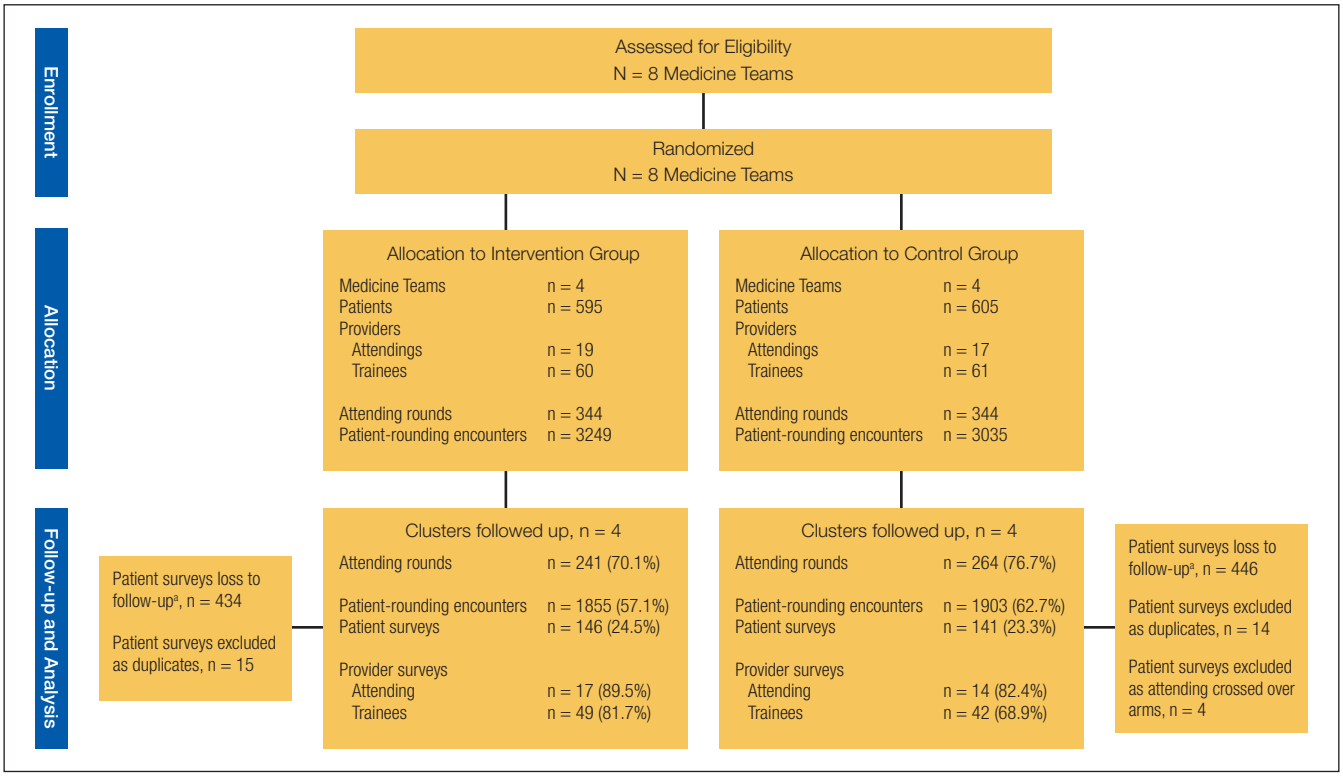

FIG. 1. Study flow diagram of progress of clusters and individuals through the phases of the randomized trial

[a]Reasons for loss to follow-up include non-English-speaking, altered mental status, not available to complete survey.

completed the survey are reported (Appendix). To compare patient satisfaction scores, we used a random-effects regression model to account for correlation among responses within teams within randomized clusters, defining teams by attending physician. As this correlation was negligible and not statistically significant, we did not adjust ordinary linear regression models for clustering. Given observed differences in patient characteristics, we adjusted for a number of covariates (eg, age, gender, insurance payer, race, marital status, trial group arm).

We conducted simple linear regression for attending and trainee satisfaction comparisons between arms, adjusting only for trainee type (eg, resident, intern, and medical student).

We compared the frequency with which intervention and control teams adhered to the 5 recommended AR practices using chi-square tests. We used independent Student's t tests to compare total duration of AR by teams within each arm, as well as mean time spent per patient.

This trial had a fixed number of arms (n = 2), each of fixed size (n = 600), based on the average monthly inpatient census on the medicine service. This fixed sample size, with 80% power and $\alpha = 0.05$, will be able to detect a 0.16 difference in patient satisfaction scores between groups.

All analyses were conducted using SAS® version 9.4 (SAS Institute, Cary, NC).

RESULTS

We observed 241 AR involving 1855 patient rounding encounters in the intervention arm and 264 AR involving 1903 patient rounding encounters in the control arm (response rates shown in Figure 1). Intervention teams adopted each of the recommended AR practices at significantly higher rates compared to control teams, with the largest difference occurring for AR occurring at the bedside (52.9% vs 5.4%; Figure 2). Teams in the intervention arm demonstrated highest adherence to the pre-rounds huddle (78.1%) and lowest adherence to whiteboard use (29.9%).

Patient Satisfaction and Clinical Outcomes

Five hundred ninety-five patients were allocated to the intervention arm and 605 were allocated to the control arm (Figure 1). Mean age, gender, race, marital status, primary language, and insurance provider did not differ between intervention and control arms (Table 1). One hundred forty-six (24.5%) and 141 (23.3%) patients completed surveys in the intervention and control arms, respectively. Patients who completed surveys in each arm were younger and more likely to have commercial insurance (Appendix).

Patients in the intervention arm reported significantly higher satisfaction with AR and felt more cared for by their medicine team (Table 2). Patient-perceived quality of communication and shared decision-making did not differ between arms.

Actual and Perceived Duration of Attending Rounds

The intervention shortened the total duration of AR by 8 minutes on average (143 vs. 151 minutes, $P = 0.052$) and

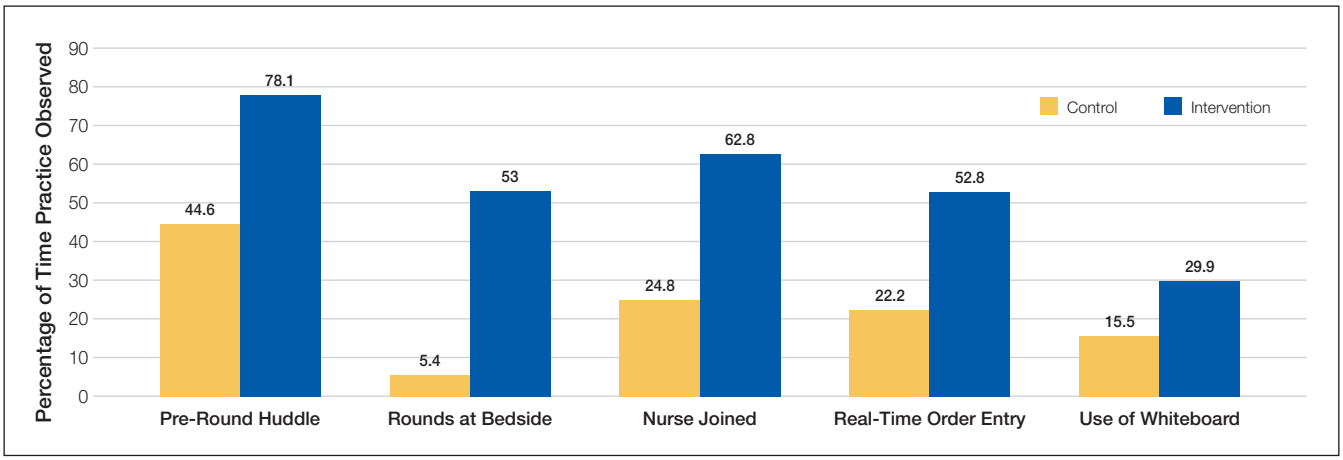

FIG. 2. Prevalence of recommended rounding practices in intervention and control patient encounters (all differences between intervention and control arms statistically significant [$P < 0.01$]).

TABLE 1. Hospitalized Patient Characteristics by Intervention and Control Arms

	Intervention n = 595	Control n = 605	*P* value
	n (%)		
Mean age, y (SD)	59.5 (18.9)	60.1 (18.7)	0.59
Gender			
Female	301 (50.6)	337 (55.7)	0.09
Race			
Asian	122 (20.5)	117 (19.3)	0.85
Black or African American	100 (16.8)	95 (15.7)	
White or Caucasian	270 (45.4)	284 (46.9)	
Other	99 (16.6)	102 (16.9)	
Unknown	4 (0.7)	7 (1.2)	
Marital status			
Married or Partnered	236 (39.7)	226 (37.3)	0.72
Single	241 (40.5)	241 (39.8)	
Divorced or Separated	58 (9.7)	68 (11.3)	
Widowed	58 (9.7)	64 (10.6)	
Unknown	2 (0.3)	6 (1.0)	
Primary language			
English	469 (78.8)	486 (80.3)	0.60
Spanish	30 (5.0)	24 (4.0)	
Chinese	56 (9.4)	62 (10.3)	
Other	40 (6.8)	33 (5.4)	
Primary insurance status			
Medicare	301 (50.6)	319 (52.7)	0.55
Medicaid	149 (25.0)	130 (21.5)	
Commercial	120 (20.2)	129 (21.3)	
Health Maintenance Organization	4 (0.7)	2 (0.3)	
Self-pay/other	21 (3.5)	25 (4.1)	

NOTE: Abbreviation: SD, standard deviation.

the time spent per patient by 4 minutes on average (19 vs 23 minutes, $P < 0.001$). Despite this, trainees in the intervention arm perceived AR to last longer (mean estimated time: 167 min vs. 152 min, $P < 0.001$).

Healthcare Provider Outcomes

We observed 79 attending physicians and trainees in the intervention arm and 78 in the control arm, with survey response rates shown in Figure 1. Attending physicians in the intervention and the control arms reported high levels of satisfaction with the quality of AR (Table 2). Attending physicians in the intervention arm were more likely to report an appropriate level of patient involvement and nurse involvement.

Although trainees in the intervention and control arms reported high levels of satisfaction with the quality of AR, trainees in the intervention arm reported lower satisfaction with AR compared with control arm trainees (Table 2). Trainees in the intervention arm reported that AR involved less autonomy, efficiency, and teaching. Trainees in the intervention arm also scored patient involvement more towards the "far too much" end of the scale compared with "about right" in the control arm. However, trainees in the intervention arm perceived nurse involvement closer to "about right," as opposed to "far too little" in the control arm.

CONCLUSION/DISCUSSION

Training internal medicine teams to adhere to 5 recommended AR practices increased patient satisfaction with AR and the perception that patients were more cared for by their medicine team. Despite the intervention potentially shortening the duration of AR, attending physicians and trainees perceived AR to last longer, and trainee satisfaction with AR decreased.

Teams in the intervention arm adhered to all recommended rounding practices at higher rates than the control teams. Although intervention teams rounded at the bedside 53% of the time, they were encouraged to bedside round only on patients who desired to participate in rounds, were not altered, and for whom the clinical discussion was not too sensitive to occur at the bedside. Of the recommended rounding behaviors, the lowest adherence was seen with whiteboard use.

A major component of the intervention was to move the

TABLE 2. Patient, Attending, and Trainee Satisfaction by Randomized Arm

Patient Satisfaction	Intervention (n = 146)	Control (n = 141)	*P* value
	Adjusted Mean (SD)[a]		
I am satisfied with morning rounds[b]	4.49 (0.73)	4.25 (0.88)	0.011
There is good communication between the medicine team and me[b]	4.32 (0.68)	4.24 (0.93)	0.390
My medicine team involved me in decisions, when appropriate[b]	4.24 (0.71)	4.07 (1.00)	0.101
My medicine team cares about me[b]	4.54 (0.60)	4.36 (0.82)	0.031
Attending Physician Satisfaction	Intervention (n = 17)	Control (n = 14)	*P* value
Overall I am satisfied with the quality of morning rounds during my time on service[c]	80.4 (9.03)	76.7 (9.82)	0.269
Time spent at the bedside was valuable[c]	80.0 (15.9)	85.4 (13.6)	0.303
I felt comfortable discussing patients' medical problems in front of patients[c]	72.7 (19.5)	65.7 (22.4)	0.345
Morning rounds were efficient	62.5 (21.6)	57.1 (26.5)	0.522
I felt comfortable teaching trainees in front of patients[c]	70.6 (22.7)	71.4 (16.9)	0.911
The amount of patient involvement during morning rounds was[d]	53.0 (9.48)	40.6 (7.58)	0.001
The amount of nursing involvement during morning rounds was[d]	44.6 (10.6)	35.7 (12.8)	0.032
Trainee Satisfaction	Intervention (n = 49)	Control (n = 41)	*P* value
Overall I am satisfied with the quality of morning rounds during my time on this Moffitt ward rotation[c]	71.0 (19.1)	78.3 (15.5)	0.046
Time spent at the bedside was valuable[c]	72.9 (19.5)	70.1 (23.1)	0.572
I felt comfortable discussing patients' medical problems in front of patients[c]	60.5 (18.8)	65.0 (25.7)	0.336
Morning rounds were efficient	60.5 (23.8)	72.3 (19.0)	0.008
Morning rounds reduced the workload for the rest of the day[c]	52.7 (21.1)	62.4 (18.3)	0.015
I had autonomy during rounds[c]	61.1 (20.8)	70.5 (19.6)	0.024
The amount of patient involvement during morning rounds was[d]	56.9 (13.3)	49.7 (12.5)	0.004
The amount of teaching conducted during morning rounds was[d]	41.0 (11.9)	48.5 (11.6)	0.003
The amount of nursing involvement during morning rounds was[d]	45.2 (9.71)	37.7 (16.1)	0.006

[a]Model adjusted for age, gender, race, payor, marital status, and trial group arm.

[b]Response options on a scale of 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating higher levels of agreement with the statement.

[c]Response options on a scale of 0 (strongly disagree) to 100 (strongly agree), with higher scores indicating higher levels of agreement with the statement.

[d]Response options were 0 (far too little) to 100 (far too much), with 50 as 'about right.'

clinical presentation to the patient's bedside. Most patients prefer being included in rounds and partaking in trainee education.[12-19,28,29,31-33] Patients may also perceive that more time is spent with them during bedside case presentations,[14,28] and exposure to providers conferring on their care may enhance patient confidence in the care being delivered.[12] Although a recent study of patient-centered bedside rounding on a nonteaching service did not result in increased patient satisfaction,[24] teaching services may offer more opportunities for improvement in care coordination and communication.[4]

Other aspects of the intervention may have contributed to increased patient satisfaction with AR. The pre-rounds huddle may have helped teams prioritize which patients required more time or would benefit most from bedside rounds. The involvement of nurses in AR may have bolstered communication and team dynamics, enhancing the patient's perception of interprofessional collaboration. Real-time order entry might have led to more efficient implementation of the care plan, and whiteboard use may have helped to keep patients abreast of the care plan.

Patients in the intervention arm felt more cared for by their medicine teams but did not report improvements in communication or in shared decision-making. Prior work highlights that limited patient engagement, activation, and shared decision-making may occur during AR.[24,34] Patient-physician communication during AR is challenged by time pressures and competing priorities, including the "need" for trainees to demonstrate their medical knowledge and clinical skills. Efforts that encourage bedside rounding should include communication training with respect to patient engagement and shared decision-making.

Attending physicians reported positive attitudes toward bedside rounding, consistent with prior studies.[13,21,31] However, trainees in the intervention arm expressed decreased satisfaction with AR, estimating that AR took longer and reporting too much patient involvement. Prior studies reflect similar bedside-rounding concerns, including perceived workflow inefficiencies, infringement on teaching opportunities, and time constraints.[12,20,35] Trainees are under intense time pressures to complete their work, attend educational conferences, and leave the hospital to attend afternoon clinic or to comply with duty-hour restrictions. Trainees value succinctness,[12,35,36] so the perception that intervention AR lasted longer likely contributed to trainee dissatisfaction.

Reduced trainee satisfaction with intervention AR may have also stemmed from the perception of decreased auton-

omy and less teaching, both valued by trainees.[20,35,36] The intervention itself reduced trainee autonomy because usual practice at our hospital involves residents deciding where and how to round. Attending physician presence at the bedside during rounds may have further infringed on trainee autonomy if the patient looked to the attending for answers, or if the attending was seen as the AR leader. Attending physicians may mitigate the risk of compromising trainee autonomy by allowing the trainee to speak first, ensuring the trainee is positioned closer to, and at eye level with, the patient, and redirecting patient questions to the trainee as appropriate. Optimizing trainee experience with bedside AR requires preparation and training of attending physicians, who may feel inadequately prepared to lead bedside rounds and conduct bedside teaching.[37] Faculty must learn how to preserve team efficiency, create a safe, nonpunitive bedside environment that fosters the trainee-patient relationship, and ensure rounds remain educational.[36,38,39]

The intervention reduced the average time spent on AR and time spent per patient. Studies examining the relationship between bedside rounding and duration of rounds have yielded mixed results: some have demonstrated no effect of bedside rounds on rounding time,[28,40] while others report longer rounding times.[37] The pre-rounds huddle and real-time order writing may have enhanced workflow efficiency.

Our study has several limitations. These results reflect the experience of a single large academic medical center and may not be generalizable to other settings. Although overall patient response to the survey was low and may not be representative of the entire patient population, response rates in the intervention and control arms were equivalent. Non-English speaking patients may have preferences that were not reflected in our survey results, and we did not otherwise quantify individual reasons for survey noncompletion. The presence of auditors on AR may have introduced observer bias. There may have been crossover effect; however, observed prevalence of individual practices remained low in the control arm. The 1.5-hour workshop may have inadequately equipped trainees with the complex skills required to lead and participate in bedside rounding, and more training, experience, and feedback may have yielded different results. For instance, residents with more exposure to bedside rounding express greater appreciation of its role in education and patient care.[20] While adherence to some of the recommended practices remained low, we did not employ a full range of change-management techniques. Instead, we opted for a "low intensity" intervention (eg, single workshop, handouts) that relied on voluntary adoption by medicine teams and that we hoped other institutions could reproduce. Finally, we did not assess the relative impact of individual rounding behaviors on the measured outcomes.

In conclusion, training medicine teams to adhere to a standardized bedside AR model increased patient satisfaction with rounds. Concomitant trainee dissatisfaction may require further experience and training of attending physicians and trainees to ensure successful adoption.

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All Together Now: Impact of a Regionalization and Bedside Rounding Initiative on the Efficiency and Inclusiveness of Clinical Rounds

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BACKGROUND: Attending rounds at academic medical centers are often disconnected from patients and team members who are not physicians. Regionalization of care teams may facilitate bedside rounding and more frequent interactions among doctors, nurses, and patients.

OBJECTIVE: We used time–motion analysis to investigate how regionalization of medical teams and encouragement of bedside rounds affect participants on rounds and rounding time.

DESIGN AND SETTING: We used pre–post analysis to study the effects of care redesign on teams' daily rounds on a general medicine service at an academic medical center.

PARTICIPANTS: Four general medical teams were evaluated before the intervention and 5 teams afterward.

INTERVENTIONS: General medical teams were regionalized to specific units, the admitting structure was changed to facilitate regionalization, and teams were encouraged to round bedside.

MEASUREMENTS: Primary outcomes included proportion of time each team member was present on rounds and proportion of bedside rounding time. Secondary outcomes included round duration and non-patient time during rounds.

RESULTS: Proportion of time the nurse was present on rounds increased from 24.1% to 67.8% ($P < 0.001$), and proportion of total bedside rounding time increased from 39.9% to 55.8% ($P < 0.001$). Mean total rounding time decreased from 3.0 hours to 2.4 hours ($P = 0.01$), despite a higher patient census.

CONCLUSIONS: Creating regionalized care teams and encouraging interdisciplinary bedside rounds increased the proportion of bedside rounding time and the presence of nurses on rounds while decreasing total rounding time. *Journal of Hospital Medicine* 2017;12:150-156. © 2017 Society of Hospital Medicine

Attending rounds at academic medical centers are often disconnected from patients and non-physician care team members. Time spent bedside is consistently less than one third of total rounding time, with observational studies reporting a range of 9% to 33% over the past several decades.[1-8] Rounds are often conducted outside patient rooms, denying patients, families, and nurses the opportunity to participate and offer valuable insights. Lack of bedside rounds thus limits patient and family engagement, patient input into the care plan, teaching of the physical examination, and communication and collaboration with nurses. In one study, physicians and nurses on rounds engaged in interprofessional communication in only 12% of patient cases.[1] Studies have found interdisciplinary bedside rounds have several benefits, including subjectively improved communication and teamwork between physicians and nurses; increased patient satisfaction, including feeling more cared for by the medical team; and decreased length of stay and costs of care.[2-10]

However, there are many barriers to conducting interdisciplinary bedside rounds at large academic medical centers. Patients cared for by a single medical team are often geographically dispersed to several nursing units, and nurses are unable to predict when physicians will round on their patients. This situation limits nursing involvement on rounds and keeps doctors and nurses isolated from each other.[2] Regionalization of care teams reduces this fragmentation by facilitating more interaction among doctors, patients, families, and nursing staff.

There are few data on how regionalized patients and interdisciplinary bedside rounds affect rounding time and the nature of rounds. This information is needed to understand how these structural changes mediate their effects, whether other steps are required to optimize outcomes, and how to maximize efficiency. We used time-motion analysis (TMA) to investigate how regionalization of medical teams, encouragement of bedside rounding, and systematic inclusion of nurses on ward rounds affect amount of time spent with patients, nursing presence on rounds, and total rounding time.

METHODS

Setting

This prospective interventional study, approved by the Institutional Review Board of Partners HealthCare, was conducted on the general medical wards at Brigham and Women's Hospital, an academic 793-bed tertiary-care center in Boston, Massachusetts. Housestaff teams consist of 1 attending, 1 resident, and 2 interns with or without a med-

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ical student. Before June 20, 2013, daily rounds on medical inpatients were conducted largely on the patient unit but outside patient rooms. After completing most of a rounding discussion outside a patient's room, the team might walk in to examine or speak with the patient. A typical medical team had patients dispersed over 7 medical units on average, and over as many as 13. As nurses were unit based, they did not consistently participate in rounds.

Intervention

In June 2013, as part of a general medical service care redesign initiative, the general medical teams were regionalized to specific inpatient units. The goal was to have teams admit patients predominantly to the team's designated unit and to have all patients on a unit be cared for by the unit's assigned team as often as possible, with an 85% goal for both. Toward those ends, the admitting structure was changed from a traditional 4-day call cycle to daily admitting for all teams, based on each unit's bed availability.[11]

Teams were also expected to conduct rounds with nurses, and a system for facilitating these rounds was established. As physician and nurse care teams were now geographically co-located, it became possible for residents and nurses to check a rounding sheet for the planned patient rounding order, which had been set by the resident and nurse-in-charge before rounds. No more than about 5 minutes was needed to prepare each day's order. The rounding sheet prioritized sick patients, newly admitted patients, and planned morning discharges, but patients were also always grouped by nurse. For example, the physician team rounded with the first nurse on all 3 of a nurse's patients, and then proceeded to the next group of 3 patients with the next nurse, until all patients were seen.

Teams were encouraged to conduct patient- and family-centered rounds exclusively at bedside, except when bedside rounding was thought to be detrimental to a patient (eg, one with delirium). After an intern's bedside presentation, which included a brief summary and details about overnight events and vital signs, the concerns of the patient, family, and nurse were shared, a focused physical examination performed, relevant data (eg, laboratory test results and imaging studies) reviewed, and the day's plan formulated. The entire team, including the attending, was expected to have read new patients' admission notes before rounds. Bedside rounds could thus be focused more on patient assessment and patient/family engagement and less on data transfer.

Several actions were taken to facilitate these changes. Residents, attendings, nurses, and other interdisciplinary team members participated in a series of focus groups and conferences to define workflows and share best practices for patient- and family-centered bedside rounds. Tips on bedside rounding were included in a general medicine rotation guidebook made available to residents and attendings. At the beginning of each post-intervention general medicine rotation, attendings and residents attended brief orientation sessions to review the new daily schedule, have interdisciplinary huddles, and share expectations for patient- and family-centered bedside rounds. On the general medicine units, new medical directors were hired to partner with existing nursing directors to support adoption of the workflows. Last, an interdisciplinary leadership team was formed to support the care redesign efforts. This team started meeting every 2 weeks.

Study Design

We used a pre–post analysis to study the effects of care redesign. Analysis was performed at the same time of year for 2 consecutive years to control for the stage of training and experience of the housestaff. TMA was performed by trained medical students using computer tablets linked to a customized Microsoft Access database form (Redmond, Washington). The form and the database were designed with specific buttons that, when pressed, recorded the time of particular events, such as the coming and going of each participant, the location of rounds, and the beginning and the end of rounding encounters with a patient. One research assistant using an Access entry form was able to dynamically track all events in real time, as they occurred. We collected data on 4 teams at baseline and 5 teams after the intervention. Each of the 4 baseline teams was followed for 4 consecutive weekdays—16 rounds total, April-June 2013—to capture the 4-day call cycle. Each of the 5 post-intervention teams was followed for 5 consecutive weekdays—25 rounds total, April–June 2014—to capture the 5-day cycle. (Because of technical difficulties, data from 1 rounding session were not captured.) For inclusion in the statistical analyses, TMA captured 166 on-service patients before the intervention and 304 afterward. Off-service patients, those with an attending other than the team attending, were excluded because their rounds were conducted separately.

We examined 2 primary outcomes, the proportion of time each clinical team member was present on rounds and the proportion of bedside rounding time. Secondary outcomes were round duration, rounding time per patient, and total non-patient time per rounding session (total rounding time minus total patient time).

Statistical Analysis

TMA data were organized in an Access database and analyzed with SAS Version 9.3 (SAS Institute, Cary, North Carolina). We analyzed the data by round session as well as by patient.

Data are presented as means with standard deviations, medians with interquartile ranges, and proportions, as appropriate. For analyses by round session, we used unadjusted linear regression; for patient-level analyses, we used general estimating equations to adjust for clustering of patients within each session; for nurse presence during any part of a round by patient, we used a χ^2 test. Total non-patient time per round session was compared with use of patient-clustered general estimating equations using a γ distribution to account for the non-normality of the data.

TABLE 1. Demographics of Patients on General Medical Service Before and After Implementation of Data Collection

Characteristic	Before Implementation (April–June 2013) N = 820	After Implementation (April–June 2014) N = 780	*P*
Mean (SD) age, y	58.8 (19.7)	58.7 (20.1)	0.89
Median (IQR) length of stay, d	4 (2, 6)	4 (2, 7)	0.24
Mean (SD) Elixhauser comorbidity score	8.1 (8.7)	8.2 (8.9)	0.84
Female, n (%)	457 (55.7%)	435 (55.8%)	>0.99
Race/ethnicity, n (%)			0.92
White	524 (64%)	494 (63%)	
Black	179 (22%)	163 (21%)	
Hispanic/Latino	68 (8%)	73 (9%)	
Other	25 (3%)	27 (3%)	
Declined/unavailable	24 (3%)	23 (3%)	
Language, n (%)			0.25
English	754 (92%)	704 (90%)	
Other	66 (8%)	76 (10%)	
Admission source, n (%)			0.049
Other facility	206 (25%)	190 (24%)	
Home	561 (68%)	560 (72%)	
Clinic	53 (6%)	30 (4%)	
Marital status			0.81
Married or living as married	299 (37%)	273 (35%)	
Divorced, separated, or widowed	197 (24%)	187 (24%)	
Single, never married	316 (39%)	311 (40%)	

NOTE: Abbreviations: IQR, interquartile range; SD, standard deviation.

RESULTS

Patient and Care Team Characteristics

Over the first year of the initiative, 85% of a team's patients were on their assigned unit, and 87% of a unit's patients were with the assigned team. Census numbers were 10.4 patients per general medicine team in April-June 2013 and 12.7 patients per team in April-June 2014, a 22% increase after care redesign. There were no statistically significant differences in patient characteristics, including age, sex, race, language, admission source, and comorbidity measure (Elixhauser score), between the pre-intervention and post-intervention study periods, except for a slightly higher proportion of patients admitted from home and fewer patients admitted directly from clinic (Table 1).

Primary Outcomes

Mean proportion of time the nurse was present on rounds per round session increased significantly ($P < 0.001$), from 24.1% to 67.8% (Figure 1A, Table 2). For individual patient encounters, the increased overall nursing presence was attributable to having more nurses on rounds and having nurses present for a larger proportion of individual rounding encounters (Figure 1B, Table 2). Nurses were present for at least some part of rounds for 53% of patients before the intervention and 93% afterward ($P < 0.001$). Mean proportion of round time by each of the 2 interns on each team decreased from 59.6% to 49.6% ($P = 0.007$).

Total bedside rounding time increased significantly ($P < 0.001$), from 39.9% before the intervention to 55.8% afterward (Table 2). Meanwhile, percentage of rounding time spent on the unit but outside patient rooms decreased significantly ($P = 0.004$), from 55.2% to 42.2%, as did rounding time on a unit completely different from the patient's (4.9% before intervention, 2.0% afterward; $P = 0.03$). Again, patient-level results were similar (Figure 2, Table 2), but the decreased time spent on the unit, outside the patient rooms, was not significant.

Secondary Outcomes

Total rounding time decreased significantly, from a mean of 182 minutes (3.0 hours) at baseline to a mean of 146 minutes (2.4 hours) after the intervention, despite the higher post-intervention census. (When adjusted for patient census, the difference increased from 35.5 to 53.8 minutes; Table 2.) Mean rounding time per patient decreased significantly, from 14.7 minutes at baseline to 10.5 minutes after the intervention. For newly admitted patients, mean rounding time per patient decreased from 30.0 minutes before implementation to 16.3 minutes afterward. Mean rounding time also decreased, though much less, for subsequent-day patients (Table 2). For both new and existing patients, the decrease in rounding time largely was a reduction in time spent rounding outside patient rooms, with minimal impact on bedside time (Table 2). Mean time nurses were present during a patient's rounds increased significantly, from 4.5 to 8.0 minutes (Table 2). Total nurse rounding time increased

from 45.1 minutes per session to 98.8 minutes. Rounding time not related to patient discussion or evaluation decreased from 22.7 minutes per session to 13.3 minutes ($P = 0.003$).

DISCUSSION

TMA of our care redesign initiative showed that this multipronged intervention, which included team regionalization, encouragement of bedside rounding with nurses, call structure changes, and attendings' reading of admission notes before rounds, resulted in an increased proportion of rounding time spent with patients and an increased proportion of time nurses were present on rounds. Secondarily, round duration decreased even as patient census increased.

Regionalized teams have been found to improve interdisciplinary communication.[1] The present study elaborates on that finding by demonstrating a dramatic increase in nursing presence on rounds, likely resulting from the unit's use of rounding schedules and nurses' prioritization of rounding orders, both of which were made possible by geographic co-localization. Other research has noted that one of the most significant barriers to interdisciplinary rounds is difficulty coordinating the start times of physician/nurse bedside rounding encounters. The system we have studied directly addresses this difficulty.[9] Of note, nursing presence on rounds is necessary but not sufficient for true physician–nurse collaboration and effective communication,[1] as reflected in a separate study of the intervention showing no significant difference in the concordance of the patient care plan between nurses and physicians before and after regionalization.[12] Additional interventions may be needed to ensure that communication during bedside rounds is effective.

Our regionalized teams spent a significantly higher proportion of rounding time bedside, likely because of a cultural shift in expectations and the increased convenience of seeing patients on the team's unit. Nevertheless, bedside time was not 100%. Structural barriers (eg, patients off-unit for dialysis) and cultural barriers likely contributed to the less than full adoption of bedside rounding. As described previously, cultural barriers to bedside rounding include trainees' anxiety about being questioned in front of patients, the desire to freely exchange academic ideas in a conference room, and attendings' doubts

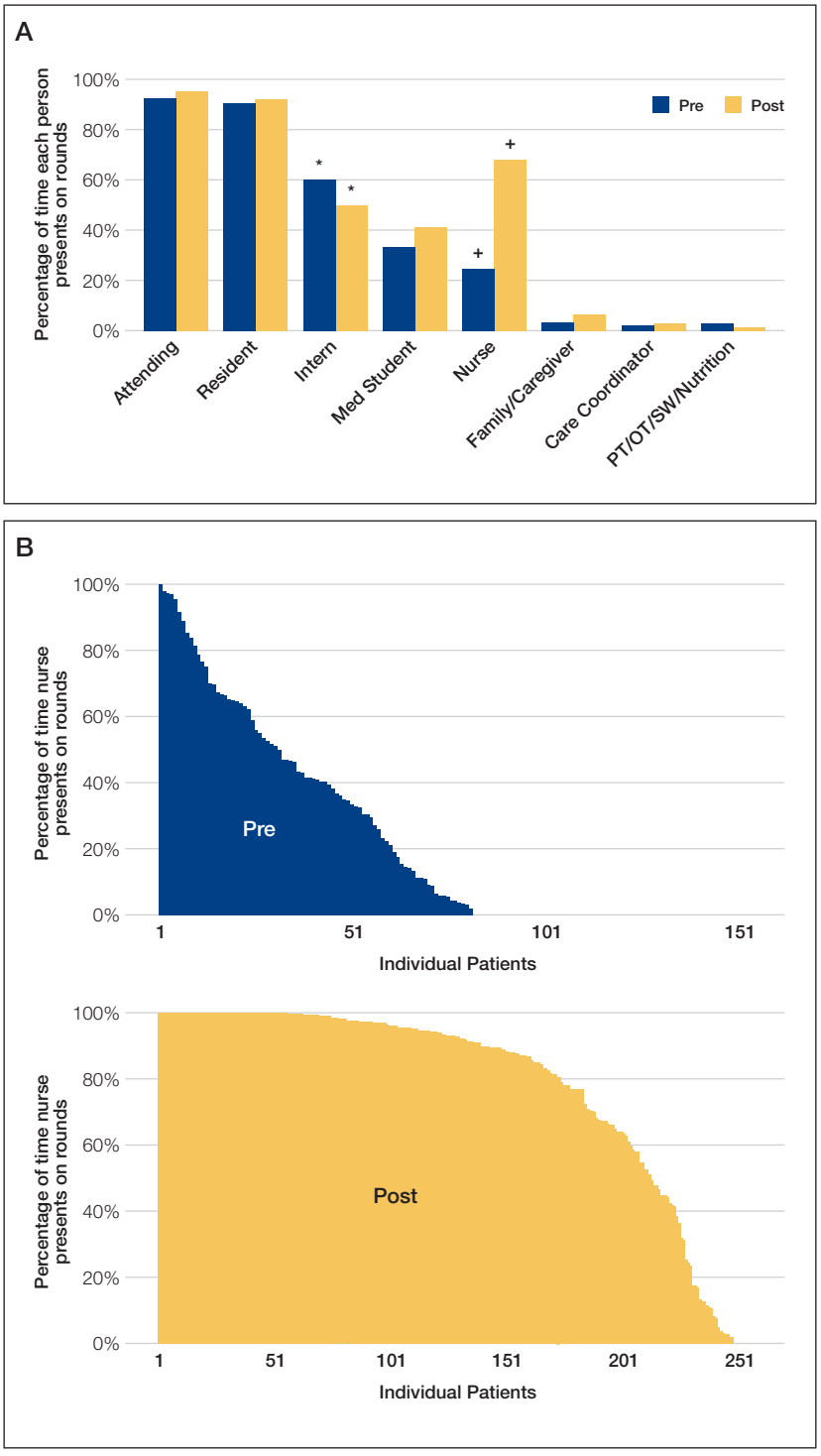

FIG. 1. Staff presence on rounds. (A) Proportion of time each care team member was present on rounds before and after intervention. Symbols indicate statistically significant differences (*$P < 0.01$; +$P < 0.001$) before and after intervention for intern and nurse. NOTE: Abbreviations: OT, occupational therapist; PT, physical therapist; SW, social worker. (B) Percentage of time nurse was present on rounds by individual patient before and after intervention. Each unit on x-axis represents patient's rounding time, with shaded vertical column denoting percentage of time nurse was present for that patient's rounds. For example, during pre-intervention period, nurse was present for 100% of rounds for 1 patient, for more than 80% of rounds for about 10 of 166 patients, and for no rounds for about half of all patients. In contrast, during post-intervention period, nurse was present for 100% of rounds for about 60 of 304 patients, for more than 80% of rounds for about 160 patients, and for no rounds for 50 patients.

TABLE 2. Primary and Secondary Outcomes

Outcome	Before Implementation, mean (SD)	After Implementation, mean (SD)	Adjusted Difference (95% CI)[a]	*P*
Analysis by rounding session	N = 16	N = 25		
Proportion of time nurse present on rounds	24.1% (10.8%)	67.8% (13.0%)	43.8% (36.2% to 51.3%)	<0.001
Proportion of time rounding bedside	39.9% (10.4%)	55.8% (14.8%)	15.9% (7.2% to 24.5%)	<0.001
Total rounding time, min	182 (53.2)	146 (30.0)	53.8 (27.6 to 80.0)[b]	<0.001
Total nurse rounding time, min	45.1 (26.1)	98.8 (25.3)	53.7 (36.9 to 70.4)	<0.001
Analysis by patient	N = 166	N = 304		
Proportion of time nurse present on rounds	22.5% (29.4%)	74.4% (33.7%)	52.0% (44.4% to 59.5%)	<0.001
Proportion of time rounding bedside	41.4% (27.6%)	53.2% (37.0%)	11.9% (2.0% to 21.8%)	0.02
Total rounding time per patient, min	14.7 (11.2)	10.5 (6.4)	4.1 (2.5 to 5.8)	<0.001
New admissions	30.0 (10.7)	16.3 (7.4)	13.8 (9.5 to 18.1)	<0.001
Subsequent-day patients	11.9 (8.8)	9.3 (5.4)	2.6 (1.1 to 4.1)	<0.001
Rounding time per patient by location, min				
New admissions—bedside	12.2 (6.9)	11.7 (5.4)	0.5 (–2.2 to 3.3)	0.71
New admissions—outside room	17.0 (8.6)	5.6 (6.1)	11.4 (6.9 to 15.9)	<0.001
Subsequent-day patients—bedside	6.4 (4.2)	6.8 (4.1)	–0.4 (–1.9 to 1.1)	0.62
Subsequent-day patients—outside room	7.0 (6.2)	4.2 (3.9)	2.8 (1.2 to 4.4)	<0.001
Total nurse rounding time per patient, min	4.5 (2.5)	8.0 (2.3)	3.6 (2.0 to 5.1)	<0.001

[a]For analyses by patient, clustered by patient within each rounding session.

[b]Adjusted for number of patients.

NOTE: Abbreviations: CI, confidence interval; SD, standard deviation.

about their bedside teaching ability.[1,9,13] Bedside rounds provide an important opportunity to apply the principles of patient- and family-centered care, including promotion of dignity and respect, information sharing, and collaboration. Thus, overcoming the concerns of housestaff and attendings and helping them feel prepared for bedside rounds can benefit the patient experience. More attention should be given to these practices as these types of interventions are implemented at Brigham and Women's Hospital and elsewhere.[1,13-15]

Another primary concern about interdisciplinary bedside rounding is the perception that it takes more time.[9] Therefore, it was important for us to measure round duration as a balancing measure to be considered for our intervention. Fortunately, we found round duration decreased with regionalization and encouragement of bedside rounding. This decrease was driven largely by a significant decrease in mean rounding time per new patient, which may be attributable at least in part to setting expectations that attendings and residents will read admission notes before rounds and that interns will summarize rather than recount information from admission notes. However, we also found rounding time decreases for subsequent-day patients, suggesting an underlying time savings. Spending a larger proportion of time bedside may therefore result in more efficient rounds. Bedside presentations can reduce redundancies, such as discussing a patient's case outside his or her room and subsequently walking in and going over much of the same information with the patient. Our model de-emphasizes data transfer in favor of discussion of care plans. There was also a decrease in non-patient time, likely reflecting reduced transit time for regionalized teams. This decrease aligns with a recent finding that bedside rounding was at least as efficient as rounding outside the room.[16]

Of note, though a larger percentage of time was spent bedside after implementation of the care redesign, the absolute amount of bedside time did not change significantly. Our data showed that, even with shorter rounds, the same amount of absolute time can be spent bedside, face to face with the patient, by increasing the proportion of bedside rounding time. In other words, teams on average did not spend more time with patients, though the content and the structure of those encounters may have changed. This finding may be attributable to eliminating redundancy, forgoing the outside-the-room discussion, and thus the largest time reductions were realized there. In addition, teams incompletely adopted beside rounds, as reflected in the data. We expect that, with more complete adoption, an even larger proportion of time will be spent bedside, and absolute time bedside might increase as a result.

An unexpected result of the care redesign was that interns' proportion of rounding time decreased after the intervention. This decrease most likely is attributable to interns' being less likely to participate in rounds for a co-intern's patient, and to their staying outside that patient's room to give themselves more time to advance the care of their own patients. Before the intervention, when more rounding time was spent outside patient rooms, interns were more likely to join rounds for their co-intern's patients because they could easily break away, as needed, to continue care of their own patients. The resident is now encouraged to use the morning huddle to identify which patients likely have the most educational value, and both interns are expected to join the bedside rounds for these patients.

This study had a few limitations. First, the pre–post design made it difficult to exclude the possibility that other temporal changes may have affected outcomes, though we did

account for time-of-year effects by aligning our data-collection phases. In addition, the authors, including the director of the general medical service, are unaware of any co-interventions during the study period. Second, the multipronged intervention included care team regionalization, encouragement of bedside rounding with nurses, call structure changes (from 4 days to daily admitting), and attendings' reading of admission notes before rounds. Thus, parsing which component(s) contributed to the results was difficult, though all the changes instituted likely were necessary for system redesign. For example, regionalization of clinicians to unit-based teams was made possible by switching to a daily admitting system.

Time that team members spent preparing for rounds was not recorded before or after the intervention. Thus, the decrease in total rounding time could have been accompanied by an increase in time spent preparing for rounds. However, admission notes were available in our electronic medical record before and after the intervention, and most residents and attendings were already reading them pre-intervention. After the intervention, pre-round note reading was more clearly defined as an expectation, and we were able to set the expectation that interns should use their presentations to summarize rather than recount information. In addition, in the post-intervention period, we did not include time spent preparing rounding orders; as already noted, however, preparation took only 5 minutes per day. Also, we did not analyze the content or the quality of the discussion on rounds, but simply recorded who was present where and when. Regarding the effect of the intervention on patient care, results were mixed. As reported in 2016, we saw no difference in frequency of adverse events with this intervention.[12] However, a more sensitive measure of adverse events—used in a study on handoffs—showed our regionalization efforts had an additive effect on reducing overnight adverse events.[17]

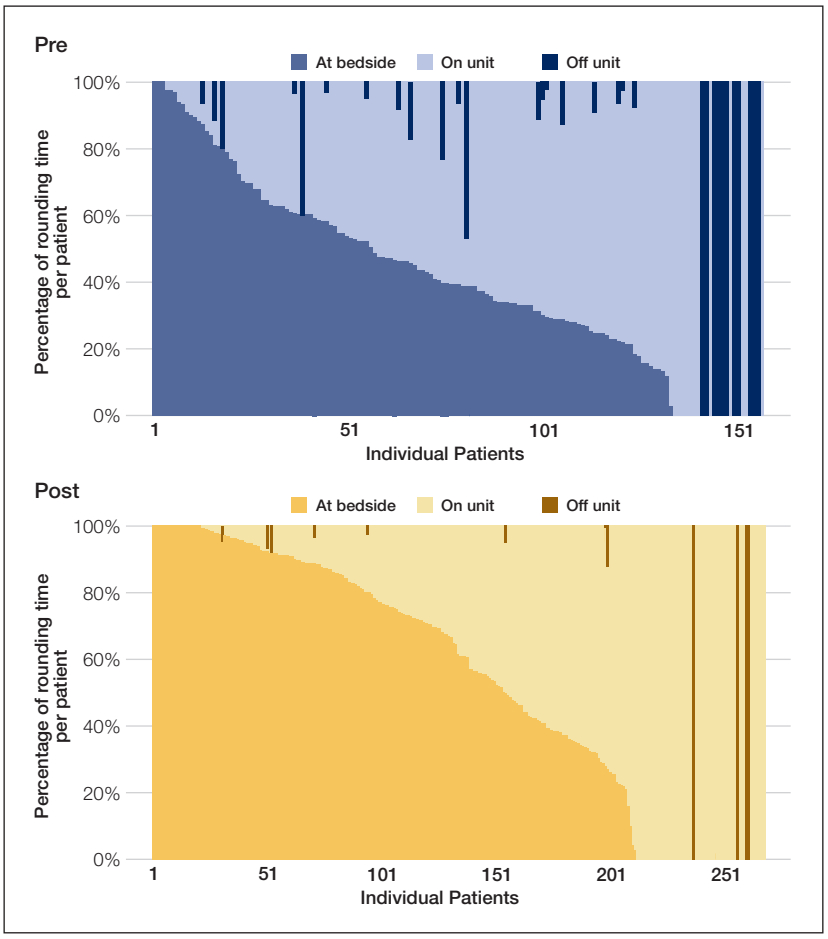

FIG. 2. Location of rounds. Each unit on x-axis represents individual patient's rounding time. Different shades show rounding time spent bedside, on patient's unit, or off unit. For example, during pre-intervention period, fewer than 20 of 166 patients had more than 80% of rounding time bedside, and about 30 had no rounding time bedside (half of these had rounding time off unit). During post-intervention period, about 100 of 304 patients had more than 80% of rounding time bedside, and fewer had rounding time off unit.

Researchers should now focus on the effects of care redesign on clinical outcomes, interdisciplinary care team communication, patient engagement and satisfaction, provider opinions of communication, workflow, patient care, and housestaff education. Our methodology can be used as a model to link structure, process, and outcome related to rounds and thereby better understand how best to optimize patient care and efficiency. Additional studies are needed to analyze the content of rounds and their association with patient and educational outcomes. Last, it will be important to conduct a study to see if the effects we have identified can be sustained. Such a study is already under way.

In conclusion, creating regionalized care teams and encouraging focused bedside rounds increased the proportion of bedside time and the presence of nurses on rounds. Rounds were shorter despite higher patient census. TMA revealed that regionalized care teams and bedside rounding at a large academic hospital are feasible, and are useful in establishing the necessary structures for increasing physician–nurse and provider–patient interactions.

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Condition Help: A Patient- and Family-Initiated Rapid Response System

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BACKGROUND: Rapid response teams (RRTs) help in delivering safe, timely care. Typically they are activated by clinicians using specific parameters. Allowing patients and families to activate RRTs is a novel intervention. The University of Pittsburgh Medical Center developed and implemented a patient- and family-initiated rapid response system called Condition Help (CH).

METHODS: When the CH system is activated, a patient care liaison or an on-duty administrator meets bedside with the unit charge nurse to address the patient's concerns. In this study, we collected demographic data, call reasons, call designations (safety or nonsafety), and outcome information for all CH calls made during the period January 2012 through June 2015.

RESULTS: Two hundred forty patients/family members made 367 CH calls during the study period. Most calls were made by patients (76.8%) rather than family members (21.8%). Of the 240 patients, 43 (18%) made multiple calls; their calls accounted for 46.3% of all calls (170/367). Inadequate pain control was the reason for the call in most cases (48.2%), followed by dissatisfaction with staff (12.5%). The majority of calls involved nonsafety issues (83.4%) rather than safety issues (11.4%). In 41.4% of cases, a change in care was made.

CONCLUSION: Patient- and family-initiated RRTs are designed to engage patients and families in providing safer care. In the CH system, safety issues are identified, but the majority of calls involve nonsafety issues. *Journal of Hospital Medicine* 2017;12:157-161. © 2017 Society of Hospital Medicine

In recent years, rapid response teams (RRTs) have been widely implemented to improve patient safety and quality of care. RRTs traditionally are activated by providers to address a clinically deteriorating patient; trained nurses, respiratory care specialists, and physicians are brought bedside to assist in triage and management. After the Joint Commission[1] endorsed patient engagement as a strategy for enhancing patient safety, new initiatives were developed to meet the challenge. Programs designed to enhance patient engagement have taken a variety of forms, including educational campaigns encouraging patients to report adverse events, requests for handwashing by providers, and the institution of patient- and family-activated RRTs.[2] Patient involvement is viewed favorably and has been shown to increase patients' perception of health care quality.[3] Although these initiatives are presumed helpful in encouraging communication, there is limited evidence that more communication leads to safety improvements. Despite the increasing prevalence of patient-activated RRTs in the United States, they have gone largely unevaluated in the adult population, and their efficacy remains unclear.

CONDITION HELP

Condition Help (CH) is a patient- and family-initiated RRT designed to prevent medical errors and communication problems and improve patient safety. Patients and families are encouraged to call the CH hotline if they believe that there has been a breakdown in care or that their health is in imminent danger. This RRT was inspired by the case of Josie King, an 18-month-old girl who died of preventable causes at a large children's hospital.[4] After her daughter's death, Sorrel King started the Josie King Foundation, an organization committed to preventing medical errors and creating a culture of patient safety. With the support of this foundation, CH was launched in 2005 at the Children's Hospital of Pittsburgh at the University of Pittsburgh Medical Center (UPMC). Later it was implemented at the UPMC adult tertiary-care center, and now it is available in all UPMC facilities.

On admission, patients receive a brochure that details the purpose of CH and provides examples of when and how to call the CH hotline. In this brochure, patients are instructed to call CH in 3 situations: "1) There is an emergency and you cannot get the attention of hospital staff, 2) You see a change in the patient's condition and the health care team is not recognizing the concern, or 3) There is breakdown in how care is given or uncertainty over what needs to be done." These instructions are printed on bulletins placed in elevators and hallways throughout the hospital. Patients and families may activate the system at any time and can even do so from home.

When a patient or family member calls the hotline, an operator notifies the CH team. This team, which consists of a patient care liaison (or an on-duty administrator) and the unit charge nurse, convenes bedside to address the patient's concern. The team was designed without a physician to ensure that the primary team remains in charge of the

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care plan. CH is kept separate from our traditional RRT and does not compete for resources (personnel, equipment, time) with the RRT, which is designed to address a clinically deteriorating patient.

In this article, we describe the characteristics of patients for whom CH was activated at our adult hospital. We also describe reasons for calls, whether changes in care were implemented, and outcomes, including traditional RRT activation, transfer to intensive care unit (ICU), and inpatient mortality. As CH was designed with patient safety as a goal, we tracked 2 types of calls, those involving safety issues and those involving nonsafety issues.

METHODS

This study was approved by the quality improvement committee at the University of Pittsburgh and was considered exempt from review by the university's Institutional Review Board.

Our integrated health system consists of more than 20 hospitals serving a tristate region. UPMC Presbyterian and UPMC Montefiore are adult tertiary-care referral hospitals with more than 750 medical/surgical beds and 150 critical care beds and more than 30,000 annual inpatient admissions. These hospitals are physically connected and function as a single large medical center. We reviewed all CH events that occurred at this combined hospital during the period January 2012 through June 2015. The dates coincided with CH data acquisition.

CH was available 24 hours a day 7 days a week. A patient care liaison (or an on-duty administrator) and the unit charge nurse responded to CH calls. Data from all calls included date and time of call, day of week, primary service, patient location, unique patient identifiers, call initiator (patient or family), whether a call led to changes in care, and primary reason for call. Each call reason was sorted into 1 of 10 categories: pain control, staff problem, lack of communication between patient/family and care team, questions about patient management, care delays, delays in a particular service, questions about discharge, administrative issues, acute psychiatric needs, and unknown/other. In addition, after a call, we reviewed all charts to determine if a safety issue was involved; Dr. Eden and Dr. Bump independently reviewed calls for safety issues and discussed any differences until they reached consensus. We also recorded outcomes, including activation of a traditional RRT or transfer to ICU within 24 hours of CH call, inpatient mortality, and against medical advice (AMA) discharges. Given that many calls were made by patients who called more than once (during a single admission or over multiple admissions), we also sorted patients into one-time callers and repeat callers for comparison. Patient satisfaction data were unavailable for review.

Patient demographic data are presented as means, standard deviations, and percentages, and call characteristics as percentages. Chi-square tests and *t* tests were used for analyses except for comparisons having few observations. For those, Fisher exact test was used. All analyses were performed with SAS Version 9.4 (SAS Institute, Cary, North Carolina).

RESULTS

From January 2012 through June 2015, 367 CH calls were made, about 105 annually. During this period, there were about 33,000 admissions, 800 combined grievances and complaints, 170 AMA discharges, 155 cardiac arrests, 2300 traditional RRT activations, and 1200 inpatient deaths per year. The 367 CH calls were made by 240 patients (Table 1). Of these 240 patients, 43 (18%) activated the CH team with multiple calls; their calls accounted for (46.3%) of all calls (170/367). The majority of calls were made by patients (76.8%) rather than family members (21.8%). Mean (SD) patient age was 45.8 (17.4) years. Mean (SD) number of admissions per patient per year was 2.7 (3.5). More events were activated for patients admitted to medical services (66%) than surgical services (34%). Calls were evenly distributed between time of day and day of week.

The most common reason for CH calls was inadequate pain control (48.2%), followed by dissatisfaction with staff (12.5%); the remaining calls were evenly distributed among the other categories. The majority of calls involved nonsafety issues (83.4%) rather than safety issues (11.4%); in 5.2% of calls, the distinction could not be made because of lack of information (Table 2). In 152 (41.4%) of the 367 total calls, a change in care or alteration in management was made. Of these 152 calls, 99 (65.1%) involved distinct changes in the care plan, such as medication changes, imaging or additional testing, or consultation with other physicians; the other 53 calls (34.9%) involved additional patient counseling or nonmedical changes. Our traditional RRT was activated within 24 hours of CH in 19 cases (5.2%); of the 19 patients, 6 were transferred to ICU. Seven patients (2.9%) died during admission. Twelve (3.3%) were discharged AMA. We compared outcomes of patients who made safety-issue calls with those of patients who made nonsafety-issue calls. The composite outcome of RRT activation, ICU transfer, and mortality was found for 6 (14.3%) of the 42 safety-issue calls and 15 (4.9%) of the 306 nonsafety-issue calls ($P = 0.0291$).

The unexpected high rate of repeat calling prompted us to compare the characteristics of one-time and repeat callers. Repeat callers were younger: Mean age was 39.3 (12.8) years for repeat callers and 47.2 (17.9) years for one-time callers ($P = 0.0012$). Repeat callers had more admissions per year: Mean (SD) number of admissions was 5.67 (5.4) for repeat callers and 2.09 (2.5) for one-time callers ($P = 0.0001$). One-time and repeat callers did not differ with respect to race or sex. Compared with one-time callers, repeat callers were more often ($P = 0.002$) admitted to medical services (74.7%) than surgical services (58.9%). For repeat callers, a larger percentage of calls ($P < 0.0001$) were made by patients (93.5%) rather than families (62.4%). Calls about pain were more often ($P < 0.0001$) made by repeat callers (62.3%) than one-time callers (36%), calls involving safety issues were less often ($P < 0.0001$) made by repeat callers (5.9%) than one-time callers (16.2%), and changes in care were made less often ($P < 0.0001$) for repeat callers (32.9%) than one-time callers (48.7%). Between-group differences in rates of RRT

TABLE 1. Descriptors and Outcomes of Patients Who Called Condition Help

Descriptor/Outcome	All (N = 240)	Callers: One-Time (n = 197)	Callers: Repeat (n = 43)	*P*[a]
Total calls, n (%)	367	197 (53.7)	170 (46.3)	—
Sex, n (%)				0.1658[b]
Male	91 (38)	79 (40)	12 (28)	
Female	149 (62)	118 (60)	31 (72)	
Race, n (%)				0.4275[b]
White	170 (70.9)	140 (71.1)	30 (69.8)	
Black	62 (25.8)	49 (24.9)	13 (30.2)	
Other	8 (3.3)	8 (4)	0	
Mean (SD) age, y	45.8 (17.4)	47.2 (17.9)	39.3 (12.8)	0.0012[c]
Mean (SD) admissions/y	2.72 (3.5)	2.09 (2.5)	5.67 (5.4)	0.0001[c]
Callers, n (%)				<0.0001[b]
Patient	282 (76.8)	123 (62.4)	159 (93.5)	
Family	80 (21.8)	69 (35)	11 (6.5)	
Unknown	5 (1.4)	5 (2.6)	0	
Time of call, n (%)				
Weekday	270 (73.6)	150 (76.1)	120 (70.6)	0.229[d]
Weekend	97 (26.4)	47 (23.9)	50 (29.4)	
Daytime	183 (49.9)	88 (44.7)	95 (55.9)	0.032[d]
Night	184 (50.1)	109 (55.3)	75 (44.1)	
Admitting service, n (%)				0.002[d]
Medicine	243 (66.2)	116 (58.9)	127 (74.7)	
Surgery	124 (33.8)	81 (41.1)	43 (25.3)	
Reason for call, n (%)				
Pain	177 (48.2)	71 (36)	106 (62.4)	<0.0001[d]
Staff	46 (12.5)	26 (13.2)	20 (11.8)	
Communication	22 (6)	16 (8.1)	6 (3.5)	
Management	26 (7.1)	17 (8.6)	9 (5.3)	
Discharge	26 (7.1)	16 (8.1)	10 (5.9)	
Timing or delays	16 (4.4)	12 (6.1)	4 (2.4)	
Administrative	9 (2.5)	7 (3.6)	2 (1.2)	
Service	18 (4.9)	16 (8.1)	2 (1.2)	
Psychiatric	13 (3.5)	5 (2.5)	8 (4.7)	
Other	3 (0.8)	2 (1)	1 (0.6)	
Unknown	11 (3)	9 (4.6)	2 (1.2)	
Primary designation of call, n (%)				<0.0001[b]
Safety	42 (11.4)	32 (16.2)	10 (5.9)	
Nonsafety	306 (83.4)	148 (75.1)	158 (92.9)	
Unknown	19 (5.2)	17 (8.6)	2 (1.2)	
Change made, n (%)				<0.0001[b]
Yes	152 (41.4)	96 (48.7)	56 (32.9)	
No	188 (51.2)	77 (39.1)	111 (65.3)	
Unknown	27 (7.4)	24 (12.2)	3 (1.8)	
Traditional rapid response call, n (%)				0.8150[b]
Yes	19 (5.2)	11 (5.6)	8 (4.7)	
No	348 (94.8)	186 (94.4)	162 (95.3)	
Escalation to ICU, n (%)				0.6901[b]
Yes	6 (1.6)	4 (2)	2 (1.2)	
No	361 (98.4)	193 (98)	168 (98.8)	
Alive at discharge, n (%)				0.3573[b]
Yes	233 (97.1)	190 (96.4)	43 (100)	
No	7 (2.9)	7 (3.6)	0 (0)	
AMA discharge, n (%)				1.0000[b]
Yes	12 (3.3)	6 (3)	6 (3.5)	
No	355 (96.7)	191 (97)	164 (96.5)	

[a]*P* values for differences between one-time and repeat callers.

[b]By Fisher exact test because of small sample size in a few cells.

[c]By 2-sided *t* test with unequal variance.

[d]By χ^2 test.

NOTE: Abbreviations: AMA, against medical advice; ICU, intensive care unit; SD, standard deviation.

TABLE 2. Examples of Condition Help Calls Attributed to Safety and Nonsafety Issues

Call Designation	Scenario	Result
Safety	Patient discharged by team felt poorly, developed fever, and called CH to contest discharge.	Discharge canceled. Caller remained inpatient for infection work-up and treatment.
Safety	Patient with ventriculoperitoneal shunt was admitted for a fall. While inpatient, fell again and developed headache, prompting CH call.	Patient underwent head imaging and shunt evaluation.
Safety	Family member of critically ill ventilated patient called CH about communication issues. Had received contradictory plans from different providers and requested clarification.	Teams and family met to discuss care plan.
Safety	Patient called CH to report mishandling of PICC by nurse. Noted that nurse did not use sterile technique during PICC maintenance and did not aspirate after administering alteplase to declog.	Case was discussed with charge nurse, who provided nursing education and changed nursing assignment.
Safety	Patient was admitted for tibial fracture and underwent surgery. Called CH for uncontrolled pain after procedure.	Surgeon was called to patient's bed to assess for compartment syndrome. Pain medication was increased.
Nonsafety	Patient called CH to request change in diet from consistent-carbohydrate to regular.	Diet was changed.
Nonsafety	Patient with chronic abdominal pain and known drug-seeking behavior called CH to request increase in pain medication.	Primary physician discussed issue with patient and established care plan. Pain medication was not increased.
Nonsafety	Patient upset about waiting 2 days for MRI.	Team unable to expedite routine MRI.
Nonsafety	Patient called CH because was concerned that parasites were eating her skin.	Psychiatry was consulted for management.
Nonsafety	Family member called CH when patient was transferred from ICU to step-down unit. Family was worried patient would receive inferior care, and wanted her to remain in ICU.	Family member was educated about step-down unit staffing and was assured that transfer was appropriate.

NOTE: Abbreviations: CH, Condition Help; ICU, intensive care unit; MRI, magnetic resonance imaging; PICC, peripherally inserted central catheter.

activation, transfer to ICU, inpatient mortality, and AMA discharges were not significant.

DISCUSSION

Patient- and family-activated RRTs provide unique opportunities for patient and family engagement during inpatient hospital stays. Our study described the results obtained with use of a well-established patient-activated RRT over several years, one of the longer observation periods reported in the literature. We found that, with use of patient-activated RRTs, patient safety issues were identified, though these were far outnumbered by nonsafety issues.

Almost half of all CH events were related to pain. Pain as the primary driver for RRT activation may be attributable to several factors, including degree of illness, poor communication about pain management expectations, positive reinforcement of narcotic-seeking behavior as a result of CH activation, and high rate of opiate use in the catchment area. A striking finding of our analysis was repeat calling; only 43 (18%) of the 240 callers were repeat callers, but they made almost half of all the calls. In some cases, during a single admission, multiple calls were made because the first had no effect on care or management; more typically, though, multiple calls were made over several admissions. Repeat callers were admitted more often per year, and they used hospital services more. They should be further studied with a goal of designing programs that better meet their needs and that prospectively address expectations of pain control.

Our study was unique in describing several outcomes related to CH events. We found that traditional RRTs were seldom activated, level of care was seldom escalated, and mortality was rare, though these outcomes occurred more often for safety-issue calls than nonsafety-issue calls. We also found that activation of CH teams often led to changes in medical management, though we could not determine whether these changes in care led to different patient outcomes.

Patient-initiated RRTs are described in a limited number of pediatric and adult studies, all with findings differing from ours. In the pediatric models, most calls were initiated by family members, were less frequent, and tended to signal higher patient acuity.[5,6] For example, in a pediatric RRT model,[5] family members activated the RRT only twice within the study year, but both calls resulted in ICU transfer. Most descriptions of patient-activated RRTs in adult hospitals are from pilot studies, which similarly identified infrequent RRT calls but often did not identify call reasons or specific outcomes.[7] A single-center study concluded that, after implementation of a mixed-model RRT[8]—a traditional practitioner-activated RRT later enhanced with a patient/family activation mechanism—non-ICU codes decreased, and there was a statistically significant drop in hospital-wide mortality rates. However, this RRT was patient-activated only 25 times over 2 years, and the specific outcomes of those events were not described.

Other initiatives have been designed to enhance patient care and communication. Purposeful rounding systems[9] involve hourly rounding by bedside nurses and daily rounding by nurse leaders to improve timely patient care and provide proactive service. Such systems ideally preempt calls involving dissatisfaction and nonsafety issues. Although they would reduce the number of patient-dissatisfaction calls made in the CH system, they may not be any better than the CH system is in its main purpose, identifying safety issues. In addition, whether patient-activated RRTs or purposeful rounding systems are better at addressing patient dissatisfaction is unclear.

This study had its limitations. First, like other studies, it was a single-center observational study without a concurrent control group. Second, because CH was first implemented 10 years ago, we could not compare patient outcomes or traditional RRT use before and after program initiation. Third, our study cohort consisted of patients hospitalized at one academic tertiary-care center in one region, and the hospital is a training site for multiple residencies and fellowships. These factors likely affect the generalizability of our data to smaller or community-based centers. Fourth, some determinations were subjective (eg, whether calls involved safety or nonsafety issues). We tried to minimize bias by having 2 authors independently review cases, but the process did not reflect patient experience or perspective. Fifth, our hospital adopted its traditional RRT years before its CH system. The criteria used by hospital personnel for traditional RRT activation are designed to encourage staff to call for help at early signs of patient deterioration. Consequently, traditional RRT activations substantially outnumber CH calls. Whether this resulted in fewer CH safety calls is unclear. Sixth, we did not capture the financial implications of using CH teams.

Although patient-activated RRTs identified patient safety issues, questions about the utility or necessity of these RRTs remain. In our era of limited hospital resources, the case has not been definitively made that these teams are practical, based on patient outcomes, though other studies have found improved patient satisfaction.[7] Most of the RRT calls in our study involved patient dissatisfaction and communication issues. CH may not be the ideal approach for managing these issues, but it represents the last line of patient advocacy once other systems have failed.

We think patient-activated RRTs have the potential to effect patient engagement in safe care. Given the importance of establishing a culture of patient safety and engagement, and increased detection of safety-related events, CH remains active throughout our hospital system. Newer iterations of CH may benefit from stricter language in defining appropriate occasions for calling RRTs, and from descriptions of other resources for patient advocacy within the hospital. These modifications could end up restricting RRT activations to patient complaints and preserving CH resources for patients with safety concerns. Our study lays the groundwork for other institutions that are considering similar interventions. Studies should now start evaluating how well patient- and family-activated RRTs improve patient satisfaction, staff satisfaction, and patient outcomes.

CONCLUSION

Patient- and family-activated RRTs were designed to engage patients and families in safe care. Although CH detects patient safety issues, these are far outnumbered by nonsafety issues. CH demonstrates a commitment to patient engagement and a culture that emphasizes patient safety.

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"We're Almost Guests in Their Clinical Care": Inpatient Provider Attitudes Toward Chronic Disease Management

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BACKGROUND: Many hospitalized patients have at least 1 chronic disease that is not optimally controlled. The purpose of this study was to explore inpatient provider attitudes about chronic disease management and, in particular, barriers and facilitators of chronic disease management in the hospital.

METHODS: We conducted a qualitative study of semi-structured interviews of 31 inpatient providers from an academic medical center. We interviewed attending physicians, resident physicians, physician assistants, and nurse practitioners from various specialties about attitudes, experiences with, and barriers and facilitators towards chronic disease management in the hospital. Qualitative data were analyzed using constant comparative analysis.

RESULTS: Providers perceived that hospitalizations offer an opportunity to improve chronic disease management, as patients are evaluated by a new care team and observed in a controlled environment. Providers perceived clinical benefits to in-hospital chronic care, including improvements in readmission and length of stay, but expressed concerns for risks related to adverse events and distraction from the acute problem. Barriers included provider lack of comfort with managing chronic diseases, poor communication between inpatient and outpatient providers, and hospital-system focus on patient discharge. A strong relationship with the outpatient provider and involvement of specialists were facilitators of inpatient chronic disease management.

CONCLUSIONS: Providers perceived benefits to in-hospital chronic disease management for both processes of care and clinical outcomes. Efforts to increase inpatient chronic disease management will need to overcome barriers in multiple domains. *Journal of Hospital Medicine* 2017;12:162-167. © 2017 Society of Hospital Medicine

Millions of individuals with chronic diseases are hospitalized annually in the United States. More than 90% of hospitalized adults have at least 1 chronic disease,[1] and almost half of Medicare beneficiaries in the hospital have 4 or more chronic conditions.[2] While many patients are admitted for worsening of a single chronic disease, patients are hospitalized more commonly for other causes. For instance, although acute heart failure is among the most frequent causes of hospitalizations among older adults, three-fourths of hospitalizations of patients with heart failure are for reasons other than acute heart failure.[3]

When a patient with a chronic disease is hospitalized, the inpatient provider must consider whether to actively or passively manage the chronic disease. Studies have suggested that intervening in chronic diseases during hospitalizations can lead to long-term improvement in treatment;[4-6] for instance, stroke patients who were started on antihypertensive therapy at discharge were more likely to have their blood pressure controlled in the next year.[5] However, some authors have argued that aggressive hypertension management by inpatient providers may result in patient harm.[7] One case-based survey suggested that hospitalists were mixed in their interest in participating in chronic disease management in the hospital.[8] This study found that providers were less likely to participate in chronic disease management if it was unrelated to the reason for hospitalization.[8] However, to our knowledge, no studies have broadly evaluated inpatient provider attitudes, motivating factors, or barriers to participation in chronic disease management.

The purpose of this study was to understand provider attitudes towards chronic disease management for patients who are hospitalized for other causes. We were particularly interested in perceptions of barriers and facilitators to delivery of inpatient chronic disease management. Ultimately, such findings can inform future interventions to improve inpatient care of chronic disease.

METHODS

In this qualitative study, we conducted in-depth interviews with providers to understand attitudes, barriers, and facilitators towards inpatient management of chronic disease; this study was part of a larger study to implement an electronic health record-based clinical decision-support system intervention to improve quality of care for hospitalized patients with heart failure.

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We included providers who care for and can write medication orders for hospitalized adult patients at New York University (NYU) Langone Medical Center, an urban academic medical center. As patients with chronic conditions are commonly hospitalized for many reasons, we sought to interview providers from a range of clinical services without consideration of factors such as frequency of caring for patients with heart failure. We used a purposive sampling framework: we invited participants to ensure a range of services, including medicine, surgery, and neurology, and provider types, including attending physicians, resident physicians, nurse practitioners, and physician assistants. Potential participants, therefore, included all providers for adult hospitalized patients.

We identified potential participants through study team members, referrals from department heads and prior interviewees, and e-mails to department list serves. We did not formally track declinations to being interviewed, although we estimate them as fewer than 20% of providers directly approached. While we focused on inpatient providers at New York University Langone Medical Center, many of the attending physicians and residents spend a portion of their time at the Manhattan Veterans Affairs Hospital and Bellevue Hospital, a safety-net city hospital; providers could have outpatient responsibilities as well.

All participants provided verbal consent to participate. The study was approved by the New York University Institutional Review Board, which granted a waiver of documentation of consent. Participants received a $25 gift card following the interview.

We used a semi-structured interview guide (Appendix) to elicit in-depth accounts of provider attitudes, experiences with, and barriers and facilitators towards chronic disease management in the hospital. The interview began by asking about chronic disease in general and then asked more specific questions about heart failure; we included responses to both groups of questions in the current study. The interview also included questions related to the clinical decision-support system being developed as part of the larger implementation study, although we do not report on these results in the current study. The semi-structured interview guide was informed by the consolidated framework for advancing implementation science (CFIR), which offers an overarching typology for delineating factors that influence guideline implementation;[9] we also used CFIR constructs in theme development. We conducted in-depth interviews with providers.

A priori, we estimated 25 interviews would be sufficient to include the purposive sample and achieve data saturation,[10] which was reached after 31 interviews. Interviews were held in person or by telephone, at the convenience of the subject. All interviews were transcribed by a professional service. Transcriptions were reviewed against recordings with any mistakes corrected. Prior to each interview, we conducted a brief demographic survey.

Qualitative data were analyzed using a constant comparative analytic technique.[11] The investigative team met after reviewing the first 10 interviews and discussed emergent themes from these early transcripts, which led to the initial code list. Two investigators coded the transcripts. Reliability was evaluated by independent coding of a 20% subset of interviews. Differences were reviewed and discussed until consensus was reached. Final intercoder reliability was determined to be greater than 95%.[12] All investigators reviewed and refined the code list during the analysis phase. Codes were clustered into themes based on CFIR constructs.[9] Analyses were performed using Atlas.ti v. 7 (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany).

TABLE 1. Provider Characteristics

Characteristic	Total N = 31	N (%)
Clinical Service		
	Medicine	12 (39)
	Surgery	12 (39)
	Neurology	4 (13)
	Other	3 (9)
Clinical Role		
	Attending	11 (35)
	Resident	12 (39)
	Physician Assistant	3 (10)
	Nurse Practitioner	5 (16)
Experience (y)		
	0-5	18 (58)
	6-10	6 (19)
	≥11	7 (23)
Gender		
	Male	17 (55)
	Female	14 (45)
Ethnicity		
	Hispanic or Latino	3 (10)
	Not Hispanic or Latino	28 (90)
Race		
	Caucasian	22 (71)
	African American	2 (6)
	Asian	5 (16)
	Other	2 (6)

RESULTS

We conducted interviews with 31 providers. Of these, 12 were on the medicine service, 12 were on the surgery or a surgical subspecialty service, and 7 were on other services; 11 were attending physicians, 12 were resident physicians, 5 were NPs, and 3 were PAs. Only 2 providers—an attending in medicine and a resident in surgery—had a specialty focus that was cardiac-related. Median time in current position was 4 years (Table 1). Seventeen of the interviews were in person, and 14 were conducted by telephone. The mean interview time was 20 minutes and ranged from 11 to 41 minutes.

We identified 5 main themes with 29 supporting codes (Table 2) describing provider attitudes towards the management of chronic disease for hospitalized patients. These themes, with related CFIR constructs, were: 1) perceived impact on patient outcomes (CFIR construct: intervention characteristics, relative advantage); 2) hospital structural

TABLE 2. Themes and Supporting Codes[a]

Perceived impact on patient outcomes
Facilitators
Decrease length of stay
Reduce readmission
Prevent complications
Barriers
Patient goal alignment
Risk of adverse side effects due to contraindication
Increase length of stay
Takes focus off primary reason patient is hospitalized
Hospital structural characteristics
Facilitators
Hospital has many resources
Opportunity to re-evaluate care
Ability to coordinate care in one place
Expedite medication titration
Ability to monitor in-house
Patient is motivated
Controlled environment
Barriers
Adjusting chronic medications while patient is in non-chronic state
Provider knowledge and self-efficacy
Facilitators
Ethical responsibility
Defer to specialist
Barriers
Inpatient provider is liable if something goes wrong
Not area of expertise
Not gratifying
Management of chronic disease is role of outpatient provider
Hospital priorities
Barriers
Hospital efficiency
Cost
Continuity and communication
Facilitators
Influenced by knowing PCP
More likely to manage chronic disease if no PCP
Barriers
Require follow-up
Outpatient provider has to inherit decision
Lack of knowledge of outpatient plan
Difficult to manage if poor outpatient follow-up

[a]Codes are categorized as those that are primarily positive attitudes towards or facilitators of inpatient chronic disease management and those that are primarily negative attitudes or barriers towards this care.

NOTE: Abbreviation: PCP, primary care provider.

characteristics (inner setting, structural characteristics); 3) provider knowledge and self-efficacy (characteristic of individual, knowledge and beliefs about the intervention and self-efficacy); 4) hospital priorities (inner setting, implementation climate, relative priority); and 5) continuity and communication (inner setting, networks and communications). For most themes, subjects described both positive and negative aspects of chronic disease management, as well as related facilitators and barriers to delivery of chronic disease care for hospitalized patients. Illustrative quotes for each theme are shown in Table 3.

Perceived Impact on Patient Outcomes

Perceived impact on patient outcomes was mixed. Most providers believed the management of chronic diseases could lead to improvement in important patient outcomes, including decreased length of stay (LOS), prevention of hospital complication, and decreased readmissions. Surgical providers focused particularly on the benefits of preventing surgical complications and noted that they were more likely to manage chronic conditions—primarily through use of specialist consultation—when they perceived a benefit to prevention of surgical outcomes or a fear that surgery may worsen a stable chronic condition:

"Most of the surgery I do is pretty stressful on the body and is very likely to induce acute on chronic exacerbations of heart failure. For someone with Class II or higher heart failure, I'm definitely gonna have cardiology on board or at least internal medicine on board right from the beginning."

However, some providers acknowledged that there were potential risks to such management, including "prolonging hospital stays for nonemergent indications" and treatment with therapies that had previously led to an "adverse reaction that wasn't clearly documented." Providers were also concerned that treating chronic conditions may take focus away from acute conditions, which could lead to worse patient-centered outcomes. One attending in medicine described it:

"If you do potentially focus on those chronic issues, and there's already a lot of other stuff going on with the patient, you might not be prioritizing the patient's active issues appropriately. The patient's saying, 'I'm in pain. I'm in pain. I'm in pain,' and you're saying, 'Thank you very much. Look, your heart failure, you didn't get your beta-blocker.' There could be a disconnect between patient's goals, expectations, and your goals and expectations."

Hospital Structural Characteristics

For many providers, the hospital setting provides a unique opportunity for care of patients with chronic disease. First, a hospitalization is a time for a patient's management to be reviewed by a new care team. The hospital team reviews the management plan for patients at admission, which is a time to reevaluate whether patients are on evidence-based therapies: "It's helpful to have a new set of eyes on somebody, like fresh information." According to providers, this reevaluation can overcome instances of therapeutic inertia by the outpatient physician. Second, the hospital has many resources, including readily available specialist services and diagnostic tests, which can allow a patient-centered approach that coordinates care in 1 place, as a surgery NP described: "I think the advantage for the patient is that they wind up stopping in for 1 thing but we wind up taking care of a few without requiring the need for him or her to go to all these different specialists on the outside. They're mostly elderly

TABLE 3. Example of Quotations for Each Theme

Perceived impact on patient outcomes	An example is if a patient is on antihypertensive medications, it might not be what you would normally start as first-line therapy… [their outside physician] may have put other thought into it, or they maybe had some adverse reaction to some medication that wasn't clearly documented or they were in another hospital system…So I think that downside can be potentially worsening their care if their specific thoughts and reasons for why they came in on something that at first glance doesn't make as much sense. —*Medicine Resident*
Hospital structural characteristics	I think you can get more done, quicker than in an outpatient setting, because you pretty much have access to a bunch of different providers on any day and they can usually see the patient within 24 hours if we need them to and that is usually very beneficial in terms of kind of changing their medication. —*Rehabilitation Resident*
Provider knowledge and self-efficacy	It seems like it's stepping on other people's toes, where people generally have a primary care provider…like where we're almost guests in their clinical care. So it's not really our job in a way. And there's a lot more pressure to just focus on the acute issue. —*Medicine Resident*
Hospital priorities	Prolonged hospitalization leads to more infection…So the quicker you get people out of the hospital, the less infection that they have, and the less, you know, deep vein thrombosis they have, and so on. So, if you're keeping them there, and that happens all the time, we are ready to send them out and the cardiologist comes in: Well, while they are here, why don't we get the echo. I was going to get the echo anyway. So they are staying another day…Not that it's inappropriate testing; it's just unnecessary in the hospital. And if you know anything about hospital economics…if the doctor does it as an outpatient, then they are making money for it. If they do it as an inpatient, they are losing money on it... it comes off the total amount that the hospital gets for the patient…So there's every motivation to do it as an outpatient. —*Neurology Attending*
Continuity and communication	I would be more likely to just call the PCP if I know who they are. Although, like I said, we would still call. We don't want to make any long-term changes that the PCP is going to have to clean up our mess. —*Neurology Nurse Practitioner*

NOTE: Abbreviation: PCP, primary care provider.

and not able to get around." Third, the high availability of services and frequent monitoring allows rapid titration of evidence-based medicines, as discussed by a medicine resident: "It's easier and faster to titrate medication—they're in a monitored setting; you can ensure compliance."

Patients may also differ from their usual state while hospitalized, creating both risks and benefits. The hospital setting can provide an opportunity to educate patients on their chronic disease(s) because they are motivated: "They're in an office visit and their sugars are out of whack or something, they may take it a little bit more seriously if they were just in the hospital even though it was on an unrelated issue. I think it probably just changes their perspective on their disease." However, in the hospital, patients are in an unusual environment with a restricted diet and forced medication compliance. Furthermore, the acute condition can lead to changes in their chronic disease, as described by 1 medicine attending: "their sugar is high because they're acutely ill." Providers expressed concern that changing medications in this setting may lead to adverse events (AEs) when patients return to their usual environment.

Provider Knowledge and Self-Efficacy

Insufficient knowledge of treatments for chronic conditions was cited as a barrier to some providers' ability to actively manage chronic disease for hospitalized patients. Some providers described management of conditions outside their area as less satisfying than their primary focus. For example, an orthopedic surgeon explained: "…it's very simple. You see your bone is broken, you fix it, that's it…it's intellectually satisfying…managing chronic diseases is less like that." Reliance on consultants was 1 approach to deal with knowledge gaps in areas outside a provider's expertise.

For a number of providers, management of stable chronic disease is the responsibility of the outpatient provider. Providers expressed concern that inpatient management was a reach into the domain of the primary care provider (PCP) and might take "away from the primary focus" of the hospitalization. Nonetheless, some providers noted an "ethical responsibility to manage [a] patient correctly," and some providers believed that engaging in chronic disease management in the hospital would present an opportunity to expand their own expertise.

A few providers were worried about legal risk related to chronic disease management: "we don't typically deal too much with managing some of these other medical issues for medical and legal reasons." Providers again suggested that consults can help overcome this concern for risk, as discussed by 1 surgical attending: "We're all not wanting to be sued, and we want to do the right thing. It costs me nothing to have a cardiologist on board, so like—why not."

Hospital Priorities

Providers explained that the hospital has strong interests in early discharge and minimizing LOS. These priorities are based on goals of improving patient outcomes, increasing bed availability and hospital volume, and reducing costs. Providers perceive these hospital priorities as potential barriers to chronic disease management, which can increase LOS and costs through additional testing and treatment. As a medicine resident described: "The DBN philosophy, 'discharge before noon' philosophy, which is part of the hospital efficiency to get people in and out of the hospital as quickly as [is] safe, or maybe faster. And I think that there's a culture where you're encouraged to only focus on the acute issue and tend to defer everything else."

Continuity and Communication

According to many providers, care continuity between the outpatient setting and the hospital played a major role in management of chronic disease. One barrier to starting a new evidence-based medication was lack of knowledge of patient history. As noted, providers expressed concern that a patient may not be on a given therapy because of an adverse reaction that was not documented in the hospital chart. This is particularly true because, as discussed by a surgery

resident, patients with "PCPs outside the system [in which providers] don't have access to the electronic medical record." To overcome this barrier, providers attempt to communicate with the outpatient provider to confirm a lack of contraindications to therapies prior to any changes; notably, communication is easier if the inpatient provider has a relationship with the outpatient PCP.

Some providers were more likely to start chronic disease therapies if the patient had no prior outpatient care, because the provider was reassured that there was no rationale for missing therapies. One neurology attending noted that if a patient had newly documented "hypertension even if they were in for something else, I might start them on an antihypertensive, but then arrange for a close follow-up with a new PCP."

Following hospitalization, providers wanted assurance that any changes to chronic disease management would be followed up by an outpatient physician. Any changes are relayed to the outpatient provider and the "level of communication…with the outpatient provider who's gonna inherit" these changes can influence how aggressively the inpatient provider manages chronic diseases. Providers may be reluctant to start therapy for patients if they are concerned about outpatient follow up: "they have diabetes and they should really technically be on an ACE [angiotensin converting enzyme]inhibitor and aspirin, but they're not. I might send them out on the aspirin but I might either start ACE inhibitor and have them follow up with their PCP in 2 weeks if I'm confident that they'll do it or if I'm really confident that they'll not follow up, I will help them get the appointment and then the discharge instruction is to the PCP is 'Please start this patient on ACE inhibitor if they show up.'"

DISCUSSION

Providers frequently perceive benefit to chronic disease management in the hospital, including improvements in clinical outcomes. Notably, providers see opportunities to improve compliance with evidence-based care to overcome potential barriers to managing chronic disease in the outpatient setting, which can be limited by pressure for brief encounters,[13] clinical inertia,[14] difficulty with close monitoring of patients,[15] and care fragmentation.[16] Concurrently, inpatient providers are concerned about potential for patient harm related to chronic disease management, primarily related to AEs from medications. Similar to a case study about a patient with outpatient hypotension following aggressive inpatient hypertension management,[7] providers fear that changing a patient's chronic disease management in a hospital setting may cause harm when the patient returns home.

Although some clinicians have argued against aggressive in-hospital chronic disease management because of concerns for risk of AEs,[7] our study and others[8] have suggested that many clinicians perceive benefit. In some cases, such as smoking cessation counseling for all current smokers and prescribing an angiotensin converting enzyme inhibitor for patients with systolic heart failure, the perceived importance is so great that chronic disease management has been used as a national quality metric for hospitals. While these hospital metrics may be justified for short-term benefits after hospitalization, studies have demonstrated only weak improvement in short-term postdischarge outcomes related to chronic disease management.[17] The true benefit is likely from improved processes of care in the short term that lead to long-term improvement in outcomes.[4,5,18] Thus, the advantage of starting a patient hospitalized for a stroke on blood pressure medication is the increased likelihood that the patient will continue the medication as an outpatient, which may reduce long-term mortality.

For hospital delivery systems that are concerned with such care process improvement through in-hospital chronic disease management, we identified a number of barriers and facilitators to delivering this care. One significant barrier was poor transitions between the inpatient and the outpatient settings. When a patient transitions into the hospital, providers need to understand prior management choices. Facilitators to help inpatient providers understand prior management included either knowing the outpatient provider, or understanding that there was a lack of regular outpatient care; in both these cases, inpatient providers felt more comfortable managing chronic diseases because they had insight into the outpatient plan, or lack thereof. However, these facilitators may not be practical to incorporate in interventions to improve chronic disease care, which should consider overcoming these communication barriers. Use of shared electronic health records or standardized telephone calls with well-documented care plans obtained through health information exchanges may facilitate an inpatient provider to manage appropriately chronic disease. Similarly, discontinuity between the inpatient provider and the outpatient provider is a barrier that must be overcome to ease concerns that any chronic disease management changes do not result in harm in the postdischarge period. These findings again point to the need for improved documentation and communication between inpatient and outpatient providers. Of course, the transitional care period is one of high risk, and improving communication between providers has been an area of ongoing work.[19]

Lack of comfort among inpatient providers with managing chronic diseases is another important barrier, which appears to be largely overcome through the use of consultation services. Ready availability of specialists, common in academic medical centers, can facilitate delivery of chronic disease management. Inpatient interventions designed to improve evidence-based care for a chronic disease may benefit from involvement or at least availability of specialists in the effort. Another major barrier relates to hospital priorities, which in our study were closely aligned with external factors such as payment models. As hospitalizations are typically paid based on the discharge diagnosis, hospitals have incentives to discharge quickly and not order extra diagnostic tests. As a result, there are disincentives for chronic disease management that may require additional testing or

monitoring in the hospital. Conversely, as hospitals accept postdischarge financial risks through readmission penalties or postdischarge cost savings, hospitals may perceive that long-term benefits of chronic disease management may outweigh short-term costs.

The study findings should be interpreted in the context of its limitations. Findings of our study of providers from a single academic medical center may not be generalizable. Nearly half of our interviews were conducted by telephone, which limits our ability to capture nonverbal cues in communication. Providers may have had social desirability bias towards positive aspects of chronic disease management. We did not have the power to determine differences in response by provider characteristic because this was an exploratory qualitative study. Future studies with representative sampling, a larger sample size, and measures for constructs such as provider self-efficacy are needed to examine differences by specialty, provider type, and experience level.

In conclusion, inpatient providers believe that hospital chronic disease management has the potential to be beneficial for both process of care and clinical outcomes; providers also express concern about potential adverse consequences of managing chronic disease during acute hospitalizations. To maximize both quality of care and patient safety, overcoming communication barriers between inpatient and outpatient providers is needed. Both a supportive hospital environment and availability of specialty support can facilitate in-hospital chronic disease management. Interventions that incorporate these factors may be well-suited to improve chronic disease care and long-term outcomes.

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The Unmet Need for Postacute Rehabilitation Among Medicare Observation Patients: A Single-Center Study

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BACKGROUND: Medicare beneficiaries admitted under observation status must pay for postacute inpatient rehabilitation (PAIR) services, out of pocket, at potentially prohibitive costs.

OBJECTIVE: To determine if there is an unmet need for PAIR among Medicare observation patients and if this care is associated with longer hospital stay and increased rehospitalization.

DESIGN/SETTING: Observational study using electronic medical record and administrative data from a regional health system.

PATIENTS: 1323 community-dwelling Medicare patients admitted under observation status.

MEASUREMENTS: Summary statistics were calculated for demographic and administrative variables. Physical therapy (PT) and case management recommendations for a representative sample of 386 medical records were reviewed regarding need for PAIR services. Linear regression was used to measure the association between PT recommendation and hospital length of stay, adjusting for *ICD-9* (*International Classification of Diseases, Ninth Revision*) diagnosis, age, sex, and provider. Chi-square test was used to determine the association between PT recommendation and 30-day hospital revisit.

RESULTS: Of the 1323 study patients, 11 (0.83%) were discharged to PAIR facilities. However, 17 (4.4%) of the 386 patients whose charts were reviewed received a recommendation for this care. Adjusted mean hospital stay was longer ($P < 0.001$) for patients recommended for rehabilitation (75.9 h) than for patients with no PT needs (46.8 h). In addition, the 30-day hospital revisit rate was higher ($P = 0.037$) for the patients who had been recommended for rehabilitation (52.9%, 9/17) than for those who had not (25.4%, 30/118).

CONCLUSIONS: Medicare observation patients' potential need for PAIR services is 5- to 6-fold higher than their use of these services. Observation patients recommended for this care may have worse outcomes. *Journal of Hospital Medicine* 2017;12:168-172. © 2017 Society of Hospital Medicine.

As the US population ages and becomes increasingly frail, the need for rehabilitation rises. By 2030, an estimated 20% of the population will be 65 years old or older, and almost 10% will be over 75.[1] About 20% of hospitalized Medicare patients receive subsequent care in postacute inpatient rehabilitation (PAIR) facilities, accounting for $31 billion in Medicare expenditures in 2014.[2] Although the need for rehabilitation will continue to rise, Medicare policy restricts access to it.

Under Medicare policy, PAIR services are covered for certain hospitalized patients but not others. Hospitalized patients are either inpatients, who are billed under Medicare Part A, or outpatients, billed under Part B. When hospital length of stay (LOS) is anticipated to be less than 2 midnights, patients are admitted as outpatients under the term *observation status;* when longer stays are expected, patients are admitted as inpatients.[3] This recently implemented time-based distinction has been criticized as arbitrary, and as potentially shifting many patients from inpatient to outpatient (observation) status.[4]

The distinction between inpatient and observation status has significant consequences for posthospital care. Medicare Part A covers care in skilled nursing facilities (SNFs) and acute inpatient rehabilitation facilities (IRFs); after hospitalization, inpatients have access to either, without copay. As observation patients are covered under Medicare Part B, they are technically not covered for either service after their hospital stay. IRFs sometimes accept patients from ambulatory and nonacute settings; observation patients may be accepted in rare circumstances, but they pay the Part A deductible ($1288 in 2016) to have the services covered by Medicare. SNF services are never covered for observation patients, and access to this care requires an average out-of-pocket payment of more than $10,503 per beneficiary for a typical SNF stay.[5] Given that about 70% of Medicare patients fall below 300% of the federal poverty line,[6] the out-of-pocket costs for PAIR services for observation patients can be prohibitive.

Although only 0.75% of community-dwelling Medicare observation patients are discharged to PAIR facilities,[7] it is unclear if the need for this care is higher but remains unmet secondary to cost concerns of Medicare beneficiaries. Also

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unclear is whether observation patients who would benefit from this care but do not receive it end up with poorer health outcomes and therefore use more healthcare services.

The purpose of this study was to estimate the proportion of Medicare observation patients who are admitted from home and receive a recommendation for placement in a PAIR facility, and to determine the ultimate disposition of such patients. We also sought to evaluate the association between recommendation for PAIR placement, LOS, and 30-day hospital revisit rate.

METHODS

The Institutional Review Board of Christiana Care Health System (CCHS) approved this study.

Sample and Design

This was an observational study of community-dwelling Medicare patients admitted under observation status to Delaware's CCHS, which consists of a 907-bed regional tertiary-care facility in Newark and a 241-bed community hospital in Wilmington. The study period was January 1 to December 31, 2013. We limited our sample to patients treated by hospitalists on hospital wards, as this care constitutes 80% of the care provided to observation patients at CCHS and the majority of care nationally.[8] As neither SNF care nor IRF care is covered under Medicare Part B, and both would result in high out-of-pocket costs for Medicare observation patients, we combined them into a single variable, PAIR.

All data were obtained from institutional electronic medical record and administrative data systems. Study inclusion criteria were Medicare as primary insurance, admission to hospital from home, and care received at either CCHS facility. Exclusion criteria were admission from PAIR facility, long-term care facility, assisted-living facility, or inpatient psychiatric facility; death; discharge against medical advice (AMA) or to hospice, non-SNF, or inpatient psychiatric facility; and discovery (during review of case management [CM] notes) of erroneous listing of Medicare as primary insurance, or of inpatient admission (within 30 days before index observation stay) that qualified for PAIR coverage under Medicare Part A.

We reviewed the medical charts of a representative (~30%) sample of the cohort and examined physical therapy (PT) and CM notes to determine the proportions of patients with recommendations for home with no services, home-based PT, possible PAIR, and PAIR. Charts were sorted by medical record number and were reviewed in consecutive order. We coded a patient as having a recommendation for possible PAIR if the PT notes indicated the patient may benefit from PAIR but could have home PT if PAIR placement was not possible. CM notes were also reviewed for evidence of patient or family preference regarding PAIR placement. All questions about PT and CM recommendations were resolved by consensus.

Measures

For the total study sample, we calculated descriptive statistics and frequencies for demographic and administrative variables, including age, sex, race (Caucasian, African American, other), ethnicity (Hispanic/non-Hispanic), *ICD-9* (*International Classification of Diseases, Ninth Revision*) primary diagnosis code, LOS (in hours) for index observation admission, discharge disposition (home with no services, home PT, possible PAIR, PAIR), and 30-day hospital revisit (emergency department, observation, inpatient admission). We used χ^2 test, Student *t* test, and analysis of variance (ANOVA) to test for statistically significant differences in characteristics between the chart review subgroup and the rest of the sample and between the groups with different disposition recommendations from PT notes.

For the chart review subgroup, we used ANOVA to calculate the unadjusted association between PT recommendation and LOS. We then adjusted for potential confounders, using multivariable linear regression with PT recommendation as a predictor and LOS as the outcome, controlling for variables previously associated with increased LOS among observation patients (primary diagnosis category, age, sex).[6] We also adjusted for hospitalist group to account for potential variability in care delivery. As LOS was not normally distributed, we calculated the fourth root of LOS, which resulted in a more normal distribution, and used the transformed values in the regression model. We then calculated predicted values from the regression and back-transformed these to obtain adjusted mean values for LOS.

RESULTS

Of the 1417 unique patients who had Medicare as primary insurance and were admitted under observation status to a hospitalist service during the study period (2013), 94 were excluded (Figure). Of the remaining 1323 patients, the majority were 65 years old or older, female, white, and non-Hispanic. The most common *ICD-9* diagnoses were syncope and chest pain. Mean LOS was 46.7 hours (range, 0-519 h). Less than 1% of patients were discharged to PAIR. Almost 25% of patients returned to the hospital, either for an emergency department visit or for observation or inpatient stay, within 30 days (Table).

Of the 419 charts reviewed to determine the proportion of patients evaluated by PT, and their subsequent recommendations, 33 were excluded, leaving 386 (92%) for analysis (Figure). There were no significant demographic differences between the patients in the chart review subgroup and the rest of the patients (Appendix). Of the 386 patients whose charts were analyzed, 181 (46.9%) had a PT evaluation, and 17 (4.4%) received a PAIR recommendation (Figure). Of the 17 patients recommended for PAIR, 12 (70.5%) were 65 years old or older, and 1 was discharged to a PAIR facility. Of the 46 patients recommended for home PT, 29 (63%) were discharged home with no services (Table).

PT-evaluated patients had unadjusted mean LOS of 52.2 hours (discharged home with no services), 64.1 hours (home PT or possible PAIR), and 83.1 hours (PAIR) ($P = 0.001$). With adjustment made for variables previously associated with increased LOS for observation patients, mean LOS for

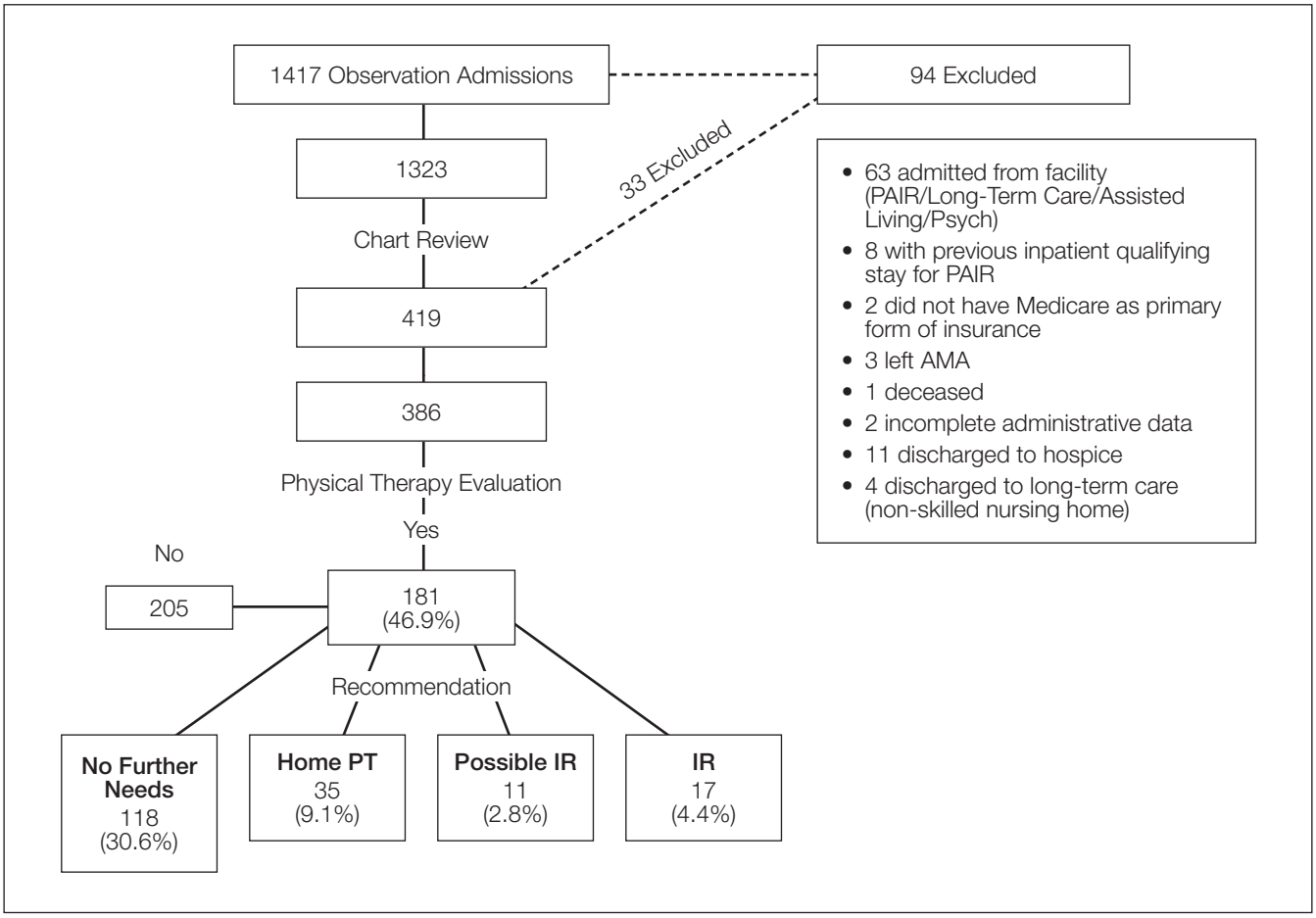

FIG. Selection of study population.

NOTE: Abbreviations: AMA, against medical advice; IR, inpatient rehabilitation; PAIR, postacute inpatient rehabilitation; PT, physical therapy.

patients recommended for PAIR remained higher than that for patients in the other 2 categories (Table). Patients recommended for PAIR were more likely to return to hospital within 30 days than patients recommended for home PT or possible PAIR and patients discharged home with no services (Table).

Review of CM notes revealed that, of the 17 patients recommended for PAIR, 7 would have accepted PAIR services had they been covered by Medicare, 4 preferred discharge with home health services, and 6 did not provide clear details of patient or family preference.

DISCUSSION

To our knowledge, this is the first study to use chart review to examine the proportion of observation patients who would benefit from PAIR and the relationships among these patients' rehabilitation needs, dispositions, and outcomes. We tried to be conservative in our estimates by limiting the study population to patients admitted from home. Nevertheless, the potential need for PAIR significantly outweighed the actual use of PAIR on discharge. The study sample was consistent with nationally representative samples of observation patients in terms of proportion of patients admitted from and discharged to facilities[7] and the most common *ICD-9* diagnoses.[9]

Physical Therapy Consultations and Observation

Of the 386 patients whose charts were reviewed and analyzed, 17 (4.4%) were evaluated as medically qualifying for and potentially benefiting from PAIR. Although the rate represents a minority of patients, it is 5- to 6-fold higher than the rate of discharge to PAIR, both in our study population and in previous national samples that used administrative data.[7] In some cases, the decision not to discharge the patient to PAIR reflected patient and family preference. However, in other cases, patients clearly could have benefited from PAIR and would have gone had it been covered by Medicare. The gap suggests an unmet need for PAIR among a substantial proportion of Medicare beneficiaries for whom the therapy is recommended and wanted.

Efforts to expand coverage for PAIR have been resisted. According to Medicare regulations, beneficiaries qualify for PAIR coverage if they are hospitalized as inpatients for 3 midnights or longer. Days under observation status do not count toward this requirement, even if this status is changed to inpatient.[10] The Medicare Payment Advisory Commission (MedPAC)

TABLE. Characteristics of Study Population and Association of Physical Therapy Recommendations and Outcomes

Characteristic	Total Sample (N = 1323)	Patients With PT Evaluation (n = 181)	PT Recommendation (n = 181)			P[a]
			Home With No Services (n = 118)	Home PT or Possible PAIR (n = 46)	PAIR (n = 17)	
Age, y						0.006
18-64	21.8% (289)	15.5% (28)	17.2% (21)	4.4% (2)	29.4% (5)	—
65-75	32.9% (436)	33.1% (60)	38.1% (45)	30.4% (14)	5.9% (1)	—
>76	45.2% (598)	51.4% (93)	44.1% (52)	65.2% (30)	64.7% (11)	—
Female sex	64.1% (848)	65.7% (119)	65.6% (78)	25.2% (30)	9.2% (11)	0.990
Race						0.735
Caucasian	76.4% (1012)	81.2% (147)	82.2% (97)	82.6% (38)	70.6 (12)	—
African American	20.2% (267)	16.6% (30)	16.1% (19)	15.2% (7)	23.5% (4)	—
Other	3.4% (44)	2.2% (4)	1.69% (2)	2.2% (1)	5.9% (1)	—
Non-Hispanic ethnicity	93.2% (1233)	93.4% (169)	92.4% (109)	97.8% (45)	88.2% (15)	0.599
Top 5 primary *ICD-9* codes						—
Syncope (780.2)	11.6% (153)	10.4% (19)	14.4% (17)	4.3% (2)	0	—
Chest pain (786.59)	8.4% (111)	3.3% (6)	5.1% (6)	0	0	—
Dizziness/giddiness (780.4)	4.2% (56)	5.5% (10)	5.1% (6)	8.7% (4)	0	—
Urinary tract infection (599)	2.9% (38)	4.4% (8)	4.2% (5)	1.7% (2)	5.9% (1)	—
Altered mental status (780.97)	2.5% (33)	3.3% (6)	1.7% (2)	2.2% (1)	17.6% (3)	—
Discharge disposition						—
Home with no services	85.3% (1128)	77.3% (140)	86.4% (102)	63% (29)	52.9% (9)	—
Home PT	13.9% (184)	22.1% (40)	13.5% (16)	37% (17)	41.2% (7)	—
PAIR	0.83% (11)	0.5% (1)	0	0	5.9% (1)	—
Length of stay,[b] h	46.7 (SD, 45.0-8.3)	46.7 (SE, 0.84)	46.8	57.3	75.9	<0.001[c]
30-day hospital revisit,[d] yes	24.3% (321)	27% (49)	25.4% (30)	21.7% (10)	52.9% (9)	0.037

[a]Comparisons calculated only for subset of patients with chart review.

[b]Model adjusted for *ICD-9* diagnosis code, age, sex, and hospitalist service.

[c]Home with no services compared with PAIR (reference); home PT or possible PAIR compared with PAIR ($P = 0.033$).

[d]Combined emergency department, observation revisit, inpatient hospitalization.

NOTE: Abbreviations: *ICD-9, International Classification of Diseases, Ninth Revision*; PAIR, postacute inpatient rehabilitation; PT, physical therapy; SD, standard deviation; SE, standard error.

recommendation that time under observation status count toward the Medicare requirement[11] has not been accepted,[12] in large part because further expansion of PAIR services likely would be unaffordable to Medicare under its payment structure.[13] Given our finding that the need for PAIR likely is much higher than previously anticipated, Medicare policy makers should consider broadening access to PAIR while efforts are made to rein in expenditures through payment reform.

One potential area of cost savings is more judicious use of PT evaluation for observation patients, particularly given our finding that the majority of PT consultations resulted in no further recommendations. Efforts to triage PT consultations for appropriateness have had some success, though the literature is scant.[14] To improve value for Medicare, healthcare systems, and patients, researchers should rigorously evaluate approaches that maximize appropriate use of PT services.

Hospital Length of Stay

Our cohort's mean hospital stay was longer than averages reported elsewhere,[9] likely reflecting our selection of Medicare patients rather than a general medicine population.[6] However, our cohort's adjusted mean hospital stay was significantly longer for patients recommended for PAIR than for patients without PT needs. That out-of-pocket costs for observation patients increase dramatically as LOS goes past 48 hours[6] could have significant financial implications for Medicare beneficiaries.

Return Visits

Almost 25% of our observation patients returned to hospital within 30 days. There was a significant trend toward increased rehospitalization among patients recommended for PAIR than among patients with no PT needs.

Policies related to PAIR for observation patients are rooted in the concern that expanded access to services will contribute to overuse of services and higher healthcare costs.[15] However, patients who could have benefited from PAIR but were not covered also were at risk for increased healthcare use and costs. A recent study found that more than one fourth of observation patients with repeat observation stays

accrued excessive financial liability.[16] Researchers should determine more precisely how the cost of coverage for PAIR placement on an index observation admission compares with the cost of subsequent healthcare use potentially related to insufficient supportive care at home.

Study Limitations

Our results must be interpreted within the context of study limitations. First is the small sample size, particularly the subset of patients selected for detailed manual chart review. We were limited in our ability to calculate sample size prospectively because we were unaware of prior work that described the association between PT recommendation and outcomes among observation patients. However, post hoc analysis estimated that a sample size of 181 patients would have been needed to determine a statistically significant difference in 30-day hospital revisit between patients recommended for PAIR and patients with no PT needs with 80% power, which we achieved. Although there are significant limitations to post hoc sample size estimation, we consider our work hypothesis-generating and hope it will lead to larger studies.

We could not account for the potential bias of the physical therapists, whose evaluations could have been influenced by knowledge of patients' observation status. Our findings could have underestimated the proportion of patients who otherwise would have been recommended for PAIR. Alternatively, therapists could have inaccurately assessed and overstated the need for PAIR. Although we could not account for the therapists' accuracy and biases, their assessments provided crucial information beyond what was previously obtained from administrative data alone.[7,9]

Hospital revisits were only accounted for within our hospital system—another potential source of underestimated findings. A significant proportion of patients recommended for home PT were discharged without services, which is counterintuitive, as Medicare covers home nursing services for observation patients. This finding most likely reflects administrative error but probably merits further evaluation.

Last, causality cannot be inferred from the results of a retrospective observational study.

CONCLUSION

As our study results suggest, there is an unmet need for PAIR services for Medicare observation patients, and LOS and subsequent use may be increased among patients recommended for PAIR. Our estimates are conservative and may underestimate the true need for services within this population. Our findings bolster MedPAC recommendations to amend the policies for Medicare coverage of PAIR services for observation patients.

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Hospital Medicine Resident Training Tracks: Developing the Hospital Medicine Pipeline

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BACKGROUND: Hospital medicine (HM) is rapidly evolving into new clinical and nonclinical roles. Traditional internal medicine (IM) residency training likely does not optimally prepare residents for success in HM. Hospital medicine residency training tracks may offer a preferred method for specialized HM education.

METHODS: Internet searches and professional networks were used to identify HM training tracks. Information was gathered from program websites and discussions with track directors.

RESULTS: The 11 HM tracks at academic medical centers across the United States focus mostly on senior residents. Track structure and curricular content are determined largely by the structure and curricula of the IM residency programs in which they exist. Almost all tracks feature experiential quality improvement projects. Content on healthcare economics and value is common, and numerous track leaders report this content is expanding from HM tracks into entire residency programs. Tracks also provide opportunities for scholarship and professional development, such as workshops on abstract creation and job procurement skills. Almost all tracks include HM preceptorships as well as rotations within various disciplines of HM.

CONCLUSIONS: HM residency training tracks focus largely on quality improvement, health care economics, and professional development. The structures and curricula of these tracks are tightly linked to opportunities within IM residency programs. As HM continues to evolve, these tracks likely will expand to bridge clinical and extra-clinical gaps between traditional IM training and contemporary HM practice. *Journal of Hospital Medicine* 2017;12:173-176. © 2017 Society of Hospital Medicine

The field of hospital medicine (HM) is rapidly expanding in the areas of clinical medicine, administration, and quality improvement (QI).[1] Emerging with this growth is a gap in the traditional internal medicine (IM) training and skills needed to be effective in HM.[1,2] These skills include clinical and nonclinical aptitudes, such as process improvement, health care economics, and leadership.[1-3] However, resident education on these topics must compete with other required curricular content in IM residency training.[2,4] Few IM residencies offer focused HM training that emphasizes key components of successful HM careers.[3,5]

Within the past decade, designated HM tracks within IM residency programs have been proposed as a potential solution. Initially, calls for such tracks focused on gaps in the clinical competencies required of hospitalists.[1] Tracks have since evolved to also include skills required to drive high-value care, process improvement, and scholarship. Designated HM tracks address these areas through greater breadth of curricula, additional time for reflection, participation in group projects, and active application to clinical care.[4] We conducted a study to identify themes that could inform the ongoing evolution of dedicated HM tracks.

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METHODS

Programs were initially identified through communication among professional networks. The phrases *hospital medicine residency track* and *internal medicine residency hospitalist track* were used in broader Google searches, as there is no database of such tracks. Searches were performed quarterly during the 2015–2016 academic year. The top 20 hits were manually filtered to identify tracks affiliated with major academic centers. IM residency program websites provided basic information for programs with tracks. We excluded tracks focused entirely on QI[6] because, though a crucial part of HM, QI training alone is probably insufficient for preparing residents for success as hospitalists on residency completion. Similarly, IM residencies with stand-alone HM clinical rotations without longitudinal HM curricula were excluded.

Semistructured interviews with track directors were conducted by e-mail or telephone for all tracks except one, the details of which are published.[7] We tabulated data and reviewed qualitative information to identify themes among the different tracks. As this study did not involve human participants, Institutional Review Board approval was not needed.

RESULTS

We identified 11 HM residency training programs at major academic centers across the United States: Cleveland Clinic, Stanford University, Tulane University, University of California Davis, University of California Irvine, University of Colorado, University of Kentucky, University of Minnesota, University of New Mexico, Virginia Commonwealth University, and Wake

TABLE 1. Demographic and Structural Characteristics of Current Hospital Medicine Tracks

Track	Start Year	Participation Numbers and Duration	Primary Content Delivery Structure
University of Colorado	2001	12/year for PGY-2 and PGY-3[a] 2-6 begin as interns in Hospitalist Leader's Track[b] Competitive selection	4 hours every other month Monthly journal club Annual retreat
Tulane University	2003	Variable participation all 3 years	Half a day every 5 weeks as part of Curriculum for Additional Skills
Virginia Commonwealth University	2005	5/year for PGY-2 and PGY-3[a]	1 hour monthly Occasional journal clubs on pertinent contemporary studies
University of California Irvine	2007	0-2 for PGY-3	Meetings based on need and availability
University of Minnesota	2009	4-6 for PGY-3 Competitive selection	Alternating blocks of clinical and nonclinical obligations during designated rotations
Cleveland Clinic	2011	3-6/year for PGY-2 and PGY-3 Competitive selection	2 consecutive months per year with alternating blocks of clinical and nonclinical obligations
University of California Davis	2014	2-6 for PGY-3	2-week block as kickoff for quality improvement project
University of Kentucky	2014	4-6 for PGY-3 Competitive selection	1 hour monthly Quarterly journal club
Wake Forest University	2014	3/year for PGY-2 and PGY-3	Alternating blocks of clinical and nonclinical obligations during designated rotations
Stanford University	2015	13 residents total for PGY-2 and PGY-3	10 seminars annually
University of New Mexico	2016	1-6/year for PGY-2 and PGY-3	2 hours monthly Quarterly journal club

[a]All residents are in a track (eg, hospital medicine, primary care, subspecialty).

[b]Track has distinct match number.

NOTE: Abbreviation: PGY, postgraduate year.

Forest University (Table 1). We reviewed the websites of about 10 other programs, but none suggested existence of a track. Additional programs contacted reported no current track.

Track Participants and Structure

HM tracks mainly target third-year residents (Table 1). Some extend into the second year of residency, and 4 have opportunities for intern involvement, including a separate match number at Colorado. Tracks accept up to 12 residents per class. Two programs, at Colorado and Virginia, are part of IM programs in which all residents belong to a track (eg, HM, primary care, research).

HM track structures vary widely and are heavily influenced by the content delivery platforms of their IM residency programs. Several HM track directors emphasized the importance of fitting into existing educational frameworks to ensure access to residents and to minimize the burden of participation. Four programs deliver the bulk of their nonclinical content in dedicated blocks; 6 others use brief recurring sessions to deliver smaller aliquots longitudinally (Table 1). The number of protected hours for content delivery ranges from 10 to more than 40 annually. All tracks use multiple content delivery modes, including didactic sessions and journal clubs. Four tracks employ panel discussions to explore career options within HM. Several also use online platforms, including discussions, readings, and modules.

Quality Improvement

The vast majority of curricula prominently feature experiential QI project involvement (Table 2). These mentored longitudinal projects allow applied delivery of content, such as QI methods and management skills. Four tracks use material from the Institute for Healthcare Improvement.[8] Several also offer dedicated QI rotations that immerse residents in ongoing QI efforts.

Institutional partnerships support these initiatives at several sites. The Minnesota track is a joint venture of the university and Regions Hospital, a nonprofit community hospital. The Virginia track positions HM residents to lead university-wide interdisciplinary QI teams. For project support, the Colorado and Kentucky tracks partner with local QI resources—the Institute for Healthcare Quality, Safety, and Efficiency at Colorado and the Office of Value and Innovation in Healthcare Delivery at Kentucky.

Health Care Economics and Value

Many programs leverage the rapidly growing emphasis on health care "value" as an opportunity for synergy between IM programs and HM tracks. Examples include involving residents in efforts to improve documentation or didactic instruction on topics such as health care finance. The New Mexico and Wake Forest tracks offer elective rotations on health care economics. Several track directors mentioned successfully expanding curricula on health care value from the HM track into IM residency programs at large, providing a measurable service to the residency programs while ensuring content delivery and freeing up additional time for track activities.

Scholarship and Career Development

Most programs provide targeted career development for residents. Six tracks provide sessions on job procurement

TABLE 2. Curricular Content Delivered in Current Hospital Medicine Tracks

Program	Quality and Safety	Healthcare Economics and Value	Scholarship and Career Development	Clinical HM Topics and Rotations
University of California Davis	QI methods Project management Change management IHI Open School modules	Covered elsewhere in IM residency program content	HM career panel Content on CV and cover letters Formal QI project mentors	No rotation
University of California Irvine	Longitudinal project	Participate on hospital committees related to longitudinal project	Assigned mentors	Rotations Geriatric medicine Palliative medicine Preoperative medicine
Cleveland Clinic	Quality and Safety Week Group QI project IHI Open School modules	Covered elsewhere in IM residency program content	Content on teaching and leadership Informal mentorship Leadership journal club	Rotations Community hospitals Palliative medicine Perioperative week Clinical journal club
University of Colorado	QI methods Change management Stakeholder assessment Longitudinal group QI project IHI Open School modules	Didactic material on: Health care finance Business drivers Resource utilization Physician billing High-value curriculum delivered during practicum	HM career panel Content on 5-year planning, CV and cover letters, interviewing, and contract negotiation Sessions on abstract and poster creation and effective presentation strategies Assigned mentors	HM preceptorship each year Rotations Geriatric medicine Palliative medicine Perioperative medicine Consultative medicine Clinical journal club
University of Kentucky	QI methods Project management Change management Longitudinal group QI project	Didactic material on: Health care finance Billing and coding Public reporting	HM career panel Content on future planning, CV and cover letters, and interviewing Sessions on inpatient teaching strategies and abstract and poster creation Resident-selected mentors	HM preceptorship, including work with APPs, perioperative medicine, and consultations Clinical journal club
University of Minnesota	QI project as pairs during PGY-2 and PGY-3	Didactic material on: Healthcare finance Documentation and coding	SHM Leadership Academy as PGY-2 residents HM retreat with HM group Content on leadership Assigned mentors	Rotations Referring hospitals Transitional care unit Perioperative medicine Palliative medicine Triage service Pain service Clinical journal club
University of New Mexico	Individual QI projects QI methods IHI Open School modules	Medical Economics elective Billing and coding High-value care Transitions of care	Content on CV, interviewing, and contract negotiation Sessions on abstract and poster creation and physicians as teachers Resident-selected QI mentors	Rotations Consultative medicine Ethics Palliative medicine Regional medical center Clinical journal club
Stanford University	QI elective rotation Individual QI project	Seminars on hospital efficiency and healthcare reimbursement	Enrollment in Stanford Faculty Development Center workshop Content on career development and burnout prevention Assigned mentors	Rotations Ultrasound diagnostics Perioperative medicine Consultative medicine
Tulane University	Leaders of residency-wide QI teams Content on leadership	Focus on value-added services	Content on abstract and poster creation Clinical coaching curriculum Assigned mentors	HM preceptorship Rotations in postacute settings
Virginia Commonwealth University	QI methods Stakeholder assessment Leaders of longitudinal interprofessional QI projects	Covered elsewhere in IM residency program content	HM career panel	HM preceptorship, including work with APPs Rotation in community hospital Clinical journal club
Wake Forest University	QI methods QI rotation	Business of Medicine elective Didactic material on billing and coding	Content on CV, interviewing, and contract negotiation 6-day leadership training workshop through university	Rotations Geriatric medicine Palliative medicine Procedural elective Perioperative medicine Rehabilitation and nursing home units

NOTE: Abbreviations: APP, advanced practice provider; CV, curriculum vitae; HM, hospital medicine; IHI, Institute for Healthcare Improvement; IM, internal medicine; PGY, postgraduate year; QI, quality improvement; SHM, Society of Hospital Medicine.

skills, such as curriculum vitae preparation and interviewing (Table 2). Many also provide content on venues for disseminating scholarly activity. The Colorado, Kentucky, New Mexico, and Tulane programs feature content on abstract and poster creation. Leadership development is addressed in several tracks through dedicated track activities or participation in discrete, outside-track events. Specifically, Colorado offers a leadership track for residents interested in hospital administration, Cleveland has a leadership journal club, Wake Forest enrolls HM residents in leadership training available through the university, and Minnesota sends residents to the Society of Hospital Medicine's Leadership Academy (Table 2).

Clinical Rotations

Almost all tracks include a clinical rotation, typically pairing residents directly with hospitalist attendings to encourage autonomy and mentorship. Several also offer elective rotations in various disciplines within HM (Table 2). The Kentucky and Virginia tracks incorporate working with advanced practice providers into their practicums. The Cleveland, Minnesota, Tulane, and Virginia tracks offer HM rotations in community hospitals or postacute settings.

HM rotations also pair clinical experiences with didactic education on relevant topics (eg, billing and coding). The Cleveland, Minnesota, and Virginia tracks developed clinical rotations reflecting the common 7-on and 7-off schedule with nonclinical obligations, such as seminars linking specific content to clinical experiences, during nonclinical time.

DISCUSSION

Our investigation into the current state of HM training found that HM track curricula focus largely on QI, health care economics, and professional development. This focus likely developed in response to hospitalists' increasing engagement in related endeavors. HM tracks have dynamic and variable structures, reflecting an evolving field and the need to fit into existing IM residency program structures. Similarly, the content covered in HM tracks is tightly linked to perceived opportunities within IM residency curricula. The heterogeneity of content suggests the breadth and ambiguity of necessary competencies for aspiring hospitalists. One of the 11 tracks has not had any residents enroll within the past few years—a testament to the continued effort necessary to sustain such tracks, including curricular updates and recruiting. Conversely, many programs now share track content with the larger IM residency program, suggesting HM tracks may be near the forefront of medical education in some areas.

Our study had several limitations. As we are unaware of any databases of HM tracks, we discussed tracks with professional contacts, performed Internet searches, and reviewed IM residency program websites. Our search, however, was not exhaustive; despite our best efforts, we may have missed or mischaracterized some track offerings. Nevertheless, we think that our analysis represents the first thorough compilation of HM tracks and that it will be useful to institutions seeking to create or enhance HM-specific training.

As the field continues to evolve, we are optimistic about the future of HM training. We suspect that HM residency training tracks will continue to expand. More work is needed so these tracks can adjust to the changing HM and IM residency program landscapes and supply well-trained physicians for the HM workforce.

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Perceived Safety and Value of Inpatient "Very Important Person" Services

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Providing care to "very important person" (VIP) patients can pose unique moral and value-based challenges for providers. No studies have examined VIP services in the inpatient setting. Through a multi-institutional survey of hospitalists, we assessed physician viewpoints and behavior surrounding the care of VIP patients. A significant proportion of respondents reported feeling pressured by patients, family members, and hospital representatives to provide unnecessary care to VIP patients. Based on self-reported perceptions, as well as case-based questions, we also found that the VIP status of a patient may impact physician clinical decision-making related to unnecessary medical care. Additional studies to quantify the use of VIP services and its effect on cost, resource availability, and patient-specific outcomes are needed. *Journal of Hospital Medicine* 2017;12:177-179.
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Recent publications in the medical literature and lay press have stirred controversy regarding the use of inpatient 'very important person' (VIP) services.[1-3] The term "VIP services" often refers to select conveniences offered in addition to the assumed basic level of care and services provided by a hospital. Examples include additional space, enhanced facilities, specific comforts, or personal support. In some instances, these amenities may only be provided to patients who have close financial, social, or professional relationships with the hospital.

How VIP patients interact with their health system to obtain VIP services has raised unique concerns. Some have speculated that the presence of a VIP patient may be disruptive to the care of non-VIP patients, while others have cautioned physicians about potential dangers to the VIP patients themselves.[4-6] Despite much being written on the topics of VIP patients and services in both the lay and academic press, our literature review identified only 1 study on the topic, which cataloged the preferential treatment of VIP patients in the emergency department.[6] We are unaware of any investigations of VIP-service use in the inpatient setting. Through a multisite survey of hospital medicine physicians, we assessed physician viewpoints and behavior regarding VIP services.

METHODS

The Hospital Medicine Reengineering Network (HOMERuN) is a nation-wide learning organization focused on measuring and improving the outcomes of hospitalized patients.[7] We surveyed hospitalists from 8 HOMERuN hospitals (Appendix 1). The survey instrument contained 4 sections: nonidentifying respondent demographics, local use of VIP services, reported physician perceptions of VIP services, and case-based assessments (Appendix 2). Survey questions and individual cases were developed by study authors and based on real scenarios and concerns provided by front-line clinical providers. Content, length, and reliability of physician understanding were assessed by a 5-person focus group consisting of physicians not included in the survey population.

Subjects were identified via administrative rosters from each HOMERuN site. Surveys were administered via SurveyMonkey, and results were analyzed descriptively. Populations were compared via the Fisher exact test. "VIP services" were defined as conveniences provided in addition to the assumed basic level of care and services (eg, private or luxury-style rooms, access to a special menu, better views, dedicated personal care attendants, hospital liaisons). VIP patients were defined as those patients receiving VIP services. A hospital was identified as providing VIP services if 50% or more of respondents from that site reported the presence of VIP services.

RESULTS

Of 366 hospitalists contacted, 160 completed the survey (44%). Respondent characteristics and reported prevalence of VIP services are demonstrated in Table 1. In total, 78 respondents (45%) reported the presence of VIP services at their hospital. Of the 8 sites surveyed, a majority of physicians at 4 sites (50%) reported presence of VIP services.

Of respondents reporting the presence of VIP services at their hospital, a majority felt that, from a patient safety perspective, the care received by VIP patients was the same as care received by non-VIP patients (Table 2). A majority reported they had felt pressured by a VIP patient or a family member to order additional tests or treatments that the physician believed were medically unnecessary and that they

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TABLE 1. Respondent Characteristics and Prevalence of VIP Services

Respondent Characteristics (N = 174 hospitalists)	
Female, n (%)	97 (56%)
Year of residency completion, median (1st, 3rd quartile)	2010 (2004, 2013)
Prevalence of VIP Services (N = 174 hospitalists at 8 hospitals)	
Physicians reporting presence of VIP services at their hospital	78 (45%)
Hospitals with a majority of physicians reporting presence of VIP services	4 (50%)
Separate unit or floor for VIP services	1(25%)
Separate room for VIP services	3(75%)

NOTE: Abbreviation: VIP, very important person.

TABLE 2. Patient Safety and Value Metrics for Physicians Reporting the Presence of VIP Services at Their Hospital (n = 72)

Patient Safety	n (%)
VIP patient care is worse than non-VIP patient care	12 (17%)
VIP patient care is the same as non-VIP patient care	56 (78%)
VIP patient care is better than non-VIP patient care	4 (6%)
Value	**Respondents Agreeing or Strongly Agreeing n (%)**
I have felt pressured by a "VIP services" patient or their family member to order additional tests or treatments that I believed were medically unnecessary	45 (63%)
I have felt pressured by other hospital employees/representatives to comply with "VIP services" patient's requests for additional tests or treatments that I believed were medically unnecessary	26 (36%)
I am more likely to comply with patient requests for additional tests or treatments that I believe are unnecessary if it is for a "VIP services" patient compared to an average patient	40 (56%)

NOTE: Abbreviation: VIP, very important person.

would be more likely to comply with VIP patient's requests for tests or treatments they felt were unnecessary. More than one-third (36%) felt pressured by other hospital employees or representatives to comply with VIP services patient's requests for additional tests or treatments that the physicians believed were medically unnecessary.

When presented the case of a VIP patient with community-acquired pneumonia who is clinically stable for discharge but expressing concerns about leaving the hospital, 61 (38%) respondents reported they would not discharge this patient home: 39 of 70 (55.7%) who reported the presence of VIP services at their hospital, and 22 of 91 (24.2%) who reported the absence of VIP services ($P < 0.001$). Of those who reported they would not discharge this patient home, 37 (61%) reported the reason for this related to the patient's connection to the Board of Trustees; 48 (79%) reported the reason for this related to the patient's concerns; 9 (15%) reported the reason for this related to their own concerns regarding medical details of the patient's case (respondents could select more than 1 reason).

When presented the case of a VIP patient with acute pulmonary embolism who is medically ready for discharge with primary care physician-approved anticoagulation and discharge plans but for whom their family requests additional consultations and inpatient hypercoagulable workup, 33 (21%) respondents reported they would order additional testing and specialist consultation: 17 of 69 (24.6%) who reported the presence of VIP services their hospital, and 16 of 91 (17.6%) who reported the absence of VIP services ($P = 0.33$). Of those who reported they would order additional testing and specialist consultation, 14 (42%) reported the reason for this related to the family's financial connections to the hospital; 30 (91%) reported the reason for this related to the family's concerns; 3 (9%) reported the reason for this related to their own concerns about the medical details of the patient's case (respondents could select more than 1 reason).

DISCUSSION

In our study, a majority of physicians who reported the presence of VIP services at their hospital felt pressured by VIP patients or their family members to perform unnecessary testing or treatment. While this study was not designed to quantify the burden of unnecessary care for VIP patients, our results have implications for individual patients and public health, including potential effects on resource availability, the identification of clinically irrelevant incidental findings, and short- and long-term medical complications of procedures, testing and radiation exposure.

Prior publications have advocated that physicians and hospitals should not allow VIP status to influence management decisions.[3,5] We found that more than one-third of physicians who reported the presence of VIP services at their hospital also reported receiving pressure from hospital representatives to provide care to VIP patients that was not medically indicated. These findings highlight an example of the tension faced by physicians who are caught between patient requests and the delivery of value-based care. This potential conflict may be amplified particularly for those patients with close financial, social, or professional ties to the hospitals (and physicians) providing their care. These results suggest the need for physicians, administrators, and patients to work together to address the potential blurring of ethical boundaries created by VIP relationships. Prevention of harm and avoidance of placing physicians in morally distressing situations are common goals for all involved parties.

Efforts to reduce unnecessary care have predominantly focused on structural and knowledge-based drivers.[4,8,9] Our results highlight the presence of additional forces. A majority of physician respondents who reported the presence of VIP services at their hospital also reported that they would be more likely to comply with requests for unnecessary care for a VIP patient as compared to a non-VIP patient. Furthermore, in case-based questions about the requests of a VIP patient and their family for additional unnecessary care, a significant portion of physicians who reported they would comply with these requests listed the VIP status of the patient or family as a factor underlying this decision. Only a minority of physicians reported their decision to provide

additional care was the result of their own medically-based concerns. Because these cases were hypothetical and we did not include comparator cases involving non-VIP patients, it remains uncertain whether the observed perceptions accurately reflect real-world differences in the care of VIP and non-VIP patients. Nonetheless, our findings emphasize the importance of better understanding the social drivers of overuse and physician communication strategies related to medically inappropriate tests.[10,11]

Demand for unnecessary testing may be driven by the mentality that "more is better."[12] Contrary to this belief, provision of unnecessary care can increase the risk of patient harm.[13] Despite physician respondents reporting that VIP patients requested and/or received additional unnecessary care, a majority of respondents felt that patient safety for VIP patients was equivalent to that for non-VIP patients. As we assessed only physician perceptions of safety, which may not necessarily correlate with actual safety, further research in this area is needed.

Our study was limited by several factors. While our study population included hospitalists from 8 geographically broad hospitals, including university, safety net, and community hospitals, study responses may not be reflective of nationwide trends. Our response rate may limit our ability to generalize conclusions beyond respondents. Second, our study captured physician perceptions of behavior and safety rather than actually measuring practice and outcomes. Studies comparing physician practice patterns and outcomes between VIP and non-VIP patients would be informative. Additionally, despite our inclusive survey design process, our survey was not validated, and it is possible that our questions were not interpreted as intended. Lastly, despite the anonymous nature of our survey, physicians may have felt compelled to respond in a particular way due to conflicting professional, financial, or social factors.

Our findings provide initial insight into how care for the VIP patient may present unique challenges for physicians, hospitals, and society by systematizing care inequities, as well as potentially incentivizing low-value care practices. Whether these imbalances produce clinical harms or benefits remains worthy of future studies.

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A Time and Motion Study of Pharmacists and Pharmacy Technicians Obtaining Admission Medication Histories

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Pharmacists' admission medication histories (AMHs) are known to reduce adverse drug events (ADEs). Pharmacist-supervised pharmacy technicians (PSPTs) have also been used in this role. Nonetheless, few studies estimate the costs of utilizing PSPTs to obtain AMHs. We used time and motion methodology to study the time and cost required for pharmacists and PSPTs to obtain AMHs for patients at high risk for ADEs. Pharmacists and PSPTs required 58.5 (95% confidence interval [CI], 46.9-70.1) and 79.4 (95% CI, 59.1-99.8) minutes per patient, respectively (P = 0.14). PSPT-obtained AMHs also required 26.0 (95% CI, 14.9-37.1) minutes of pharmacist supervision per patient. Based on 2015 US Bureau of Labor Statistics wage data, we estimated the cost of having pharmacists and PSPTs obtain AMHs to be $55.91 (95% CI, 44.9-67.0) and $45.00 (95% CI, 29.7-60.4), respectively, which included pharmacist supervisory cost, per patient (P = 0.32). Thus, we found no statistically significant difference in time or cost between the two provider types. *Journal of Hospital Medicine* 2017;12:180-183. © 2017 Society of Hospital Medicine

Using pharmacists to obtain admission medication histories (AMHs) reduces medication errors by 70% to 83% and resultant adverse drug events (ADEs) by 15%.[1-3] Dissemination of this practice has been limited by several factors, including clinician practice models, staff availability, confusion in provider roles and accountability, and absence of standardized best practices.[4-5] This paper assesses one of these barriers: the high cost of utilizing pharmacists. Third-person observer time and motion analysis shows that pharmacists require 46 and 92 minutes to obtain AMHs from medical and geriatric patients,[6] respectively, resulting in pharmacist costs of $44 to $88 per patient, based on 2015 US Bureau of Labor Statistics (BLS) hourly wage data for pharmacists ($57.34).[7]

Pharmacist-supervised pharmacy technicians (PSPTs) achieve AMH accuracy comparable to pharmacists,[8-9] but their hourly wages are only 26% of pharmacists'.[7] We conducted a third-person observer time and motion study[10] to compare the amount of time and labor cost necessary for pharmacists and PSPTs to obtain AMHs for patients at high risk for ADEs.

METHODS

This study originated as part of a randomized, controlled trial conducted during January-February 2014 at Cedars-Sinai Medical Center (CSMC), an 896-bed, university-affiliated, not-for-profit hospital.[9] Pharmacy staff included pharmacists, PGY-1 pharmacy residents, and pharmacy technicians, each of whom received standardized didactic and experiential training (Appendix 1).

The pharmacists' AMH and general pharmacy experience ranged from <1 to 3 years and <1 to 5 years, respectively. For PSPTs, AMH and general pharmacy experience ranged from <1 to 2 years and 1 to 17 years, respectively. Three additional pharmacists were involved in supervising PSPTs, and their experience fell within the aforementioned ranges, except for one pharmacist with general pharmacy experience of 16 years. The CSMC Institutional Review Board approved this study with oral consent from pharmacy staff.

For the trial, pharmacists and PSPTs obtained AMHs from 185 patients identified as high-risk for ADEs in the CSMC Emergency Department (ED). Patients were randomized into each arm using RANDI2 software[11] if they met one of the trial inclusion criteria, accessed via electronic health record (EHR) (Appendix 2). For several days during this trial, a trained research nurse shadowed pharmacists and PSPTs to record tasks performed, as well as the actual time, including start and end times, dedicated to each task.

After excluding AMHs with incomplete data, we calculated mean AMH times and component task times (Table). We compared mean times for pharmacists and PSPTs using two sample t tests (Table). We calculated mean times of tasks across only AMHs that required the task, mean times of tasks across all AMHs studied, regardless of whether the AMH required the task or not (assigning 0 minutes for the task if it was not required), and percent mean time of task per patient for providers combined (Table).

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TABLE. Observed Admission Medication History Tasks and Time Spent[a]

		Mean Times Based on AMHs that Required this Task (n = reported in each section)				Mean Times Based Across All AMHs (Combined n = 30, Pharmacists n = 12, PSPTs n = 18)				
Observed AMH Tasks	Observed AMH Task Descriptions	Mean Time for Providers Combined (minutes)	Mean Time for Pharmacists (minutes)	Mean Time for PSPTs (minutes)	*P* value[b]	Mean Time for Providers Combined (minutes)	Mean Time for Pharmacists (minutes)	Mean Time for PSPTs (minutes)	*P* value[b]	% Mean Time per Patient for Providers Combined
Direct Patient Care Activities	Discussion with patient and/or family member/ caregiver at bedside[c]	20.4 (95% CI 15.5-25.2) n = 21	19.1 (95% CI 13.3-24.9) n = 9	21.3 (95% CI 13.9-28.8) n = 12	.67	14.3 (95% CI 9.5-19.0)	14.3 (95% CI 7.8-20.9)	14.2 (95% CI 7.4 – 21.1)	.98	17.7% (95% CI 12.0-23.4)
Utilizing Secondary Resources	Obtain medication information from outpatient pharmacies via phone and/or fax[d]	15.8 (95% CI 10.2-21.4) n = 18	13.8 (95% CI 8.9-18.6) n = 8	17.4 (95% CI 8.0-26.9) n = 10	.54	9.5 (95% CI 5.1-13.8)	9.2 (95% CI 4.2-14.1)	9.7 (95% CI 3.1-16.2)	.91	11.6% (95% CI 6.6-16.6)
	Obtain medication information from care-givers or family members who are not present	8.8 (95% CI 4.6-13.0) n = 5	17 n = 1	6.8 (95% CI 5.1-8.6) n = 4	N/A[l]	1.5 (95% CI 0.1-2.8)	1.4 (95% CI -1.4-4.2)	1.5 (95% CI 0.1-2.9)	.74	1.7% (95% CI -0.1%-3.5%)
	Obtain medication information from MD offices	12.3 (95% CI 4.3-20.3) n = 4	9 n = 1	13.3 (95% CI 2.5-24.2) n = 3	N/A[l]	1.6 (95% CI -0.1-3.4)	0.8 (95% CI -0.7-2.2)	2.2 (95% CI -0.6-5.0)	.44	1.1% (95% CI 0.0-2.2)
	Obtain medication information from dialysis centers	7.8 (95% CI 3.9-11.6) n = 4	11 n = 1	6.7 (95% CI 2.1-11.2) n = 3	N/A[l]	1.1 (95% CI 0.0-2.2)	0.9 (95% CI -0.9-2.7)	1.1 (95% CI -0.2-2.5)	.86	1.3% (95% CI 0.1-2.6)
	Obtain medication information from SNFs[e]	11.1 (95% CI 8.7-13.5) n = 9	11.7 (95% CI 9.9-13.4) n = 3	10.8 (95% CI 7.2-14.4) n = 6	.77	3.3 (95% CI 1.3-5.3)	2.9 (95% CI -0.1-5.9)	3.6 (95% CI 0.9-6.3)	.74	6.1% (95% CI 2.1-10.1)
Utilizing Electronic Health Record	Review the patient's EHR prior to seeing the patient[f] Update AMH in EHR and document pharmacist verification of the AMH[g] Write pharmacist AMH note[h] Complete order for pharmacist to obtain AMH	30.1 (95% CI 24.5-35.6) n = 30	32.0 (95% CI 25.4-38.6) n = 12	28.8 (95% CI 20.5-37.2) n = 18	.60	30.1 (95% CI 24.5-35.6)	32.0 (95% CI 25.4-38.6)	28.8 (95% CI 20.5-37.2)	.60	42.8% (95% CI 37.4-48.2)
Pharmacist Supervision of Technicians[i]	Provide workflow guidance, if needed[j] Verify technician completed AMH[k] Verify technician AMH with patient and/or secondary resources, if needed Provide feedback for technician AMH errors, if needed	26.0 (95% CI 14.9-37.1) n = 18	- n = 0	26.0 (95% CI 14.9-37.1) n = 18	N/A[l]	26.0 (95% CI 14.9-37.1) n = 18	- n = 0	26.0 (95% CI 14.9-37.1) n = 18	N/A[l]	17.3% (95% CI 10.8-23.8)
Miscellaneous	Request interpreter	8.0 n = 1	8.0 n = 1	- n = 0	N/A[l]	0.3 (95% CI -0.3-0.8)	0.7 (95% CI -0.6-2.0)	- n = 0	N/A[l]	0.3% (95% CI -0.3-0.9)

[a]Total time to obtain an AMH includes tasks below. Note: Not all tasks are required for each AMH.

[b]Comparison of mean time to complete tasks for pharmacists vs. PSPTs using two sample t tests.

[c]May include discussing the following: Introducing self to patient and assessing mental status; identifying the patient's primary caregiver for medications, if not the patient; reviewing the patient's medication list and/or pill bottles, if available; reviewing prescription medications, OTC medications, and non-oral medications; assessing patient medication literacy and adherence; providing medication education; determining last dose of medications; and obtaining pharmacy/secondary resource information.

[d]Time to obtain pharmacy fill data.

[e]May include the following: Reviewing SNF MAR sent with patient; calling SNFs for medication list or to fax SNF MAR, if not sent with the patient; and calling SNF for clarification of SNF MAR.

[f]May include reviewing the following: Current unvalidated AMH; subjective and objective patient information for current admission; recent hospitalizations; and recent outpatient records.

[g]May include updating the following: Deleting, modifying, and adding medications based on validated AMH; selecting EHR medication entries, while considering inpatient formulary and ensuring patients are discharged on home medications vs. formulary substitutions; and providing time of last dose of medications for scheduling of first inpatient dose, if ordered.

[h]May include documenting the following: Resources utilized to obtain the AMH; outpatient, hospital discharge, or long-term care facility medication errors; patient self-adjustments or self-discontinuing of medications; recent significant MD changes; patient medication adherence or literacy issues; and patient medication concerns.

[i]Pharmacist time to supervise PSPTs.

[j]May include providing guidance for the following: Information that needs to be clarified with the patient; next steps in reconciling sources of information; how to update the AMH in the EHR.

[k]Based on sources of information obtained by the PSPT and PSPT presentation of AMH.

[l]Unable to calculate *P* value due to inadequate n in each arm.

NOTE: Abbreviations: AMH, admission medication history; CI, confidence interval; EHR, electronic health record; MAR, medication administration record; MD, medical doctor; OTC, over-the-counter; PSPTs, pharmacist-supervised pharmacy technicians; SNF, skilled nursing facility.

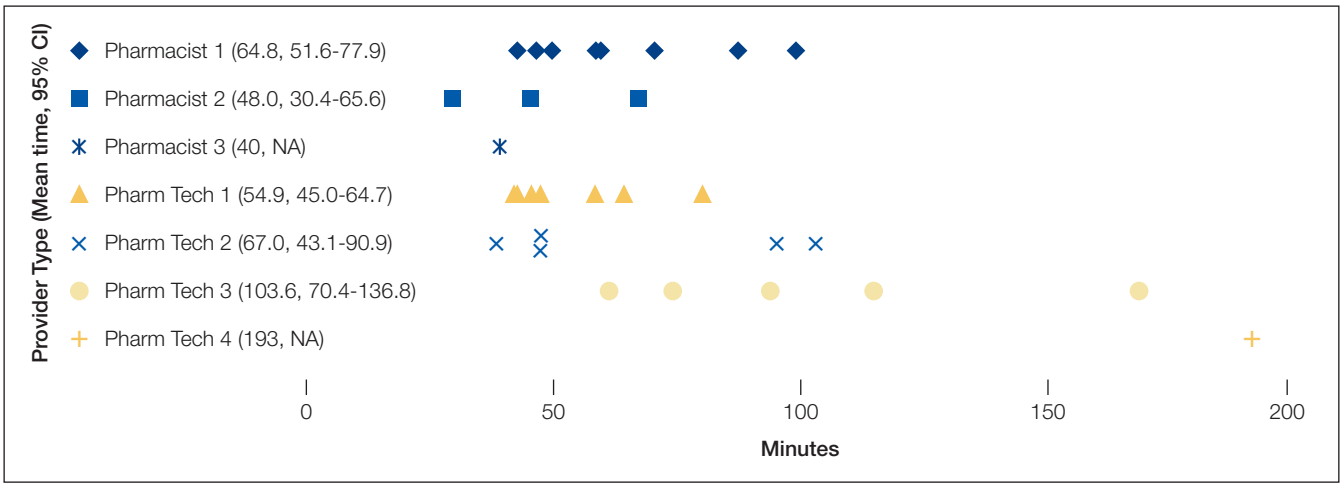

FIG. Time necessary for pharmacists and pharmacist-supervised pharmacy technicians to obtain an admission medication history.

NOTE: Abbreviation: CI, confidence interval.

We calculated Pearson product-moment correlation estimates between AMH time and these continuous variables: patient age; total number of EHR medications; number of chronic EHR medications; years of provider AMH experience; and years of provider general pharmacy experience. Using two sample *t* tests, we also checked for associations between AMH time and the following categorical variables: sex; presence of a patient-provided medication list; caregiver availability; and altered mental status, as determined by review of the ED physician's note. Caregiver availability was defined as the availability of a family member, caregiver, or medication administration record (MAR) for patients residing at a skilled nursing facility (SNF). The rationale for combining these variables is that SNF nurses are the primary caregivers responsible for administering medications, and the MAR is reflective of their actions.

After reviewing our initial data, we decided to increase our sample size from 20 to 30 complete AMHs. Because the trial had concluded, we selected 10 additional patients who met trial criteria and who would already have an AMH obtained by pharmacy staff for operational reasons. The only difference with the second set of patients (n = 10) is that we did not randomize patients into each arm, but chose to focus on AMHs obtained by PSPTs, as there is a greater need in the literature to study PSPTs. After finalizing data collection, the aforementioned analyses were conducted on the complete data set.

Lastly, we estimated the mean labor cost for pharmacists and PSPTs to obtain an AMH by using 2015 US BLS hourly wage data for pharmacists ($57.34) and pharmacy technicians ($15.23).[7] The cost for a pharmacist-obtained AMH was calculated by multiplying the measured mean time a pharmacist needed to obtain an AMH by $57.34 per hour. The cost for a PSPT-obtained AMH was the sum of the PSPT's measured mean time to obtain an AMH multiplied by $15.23 per hour and the measured mean pharmacist supervisory time multiplied by $57.34 per hour.

RESULTS

Of the 37 observed AMHs, 30 had complete data. Seven AMHs were excluded because not all task times were recorded, due to the schedule restraints of the research nurse. Pharmacists and PSPTs obtained 12 and 18 AMHs, respectively. Mean patient ages were 83.3 (95% confidence interval [CI], 77.3-89.2) and 79.8 (95% CI, 71.5-88.0), for pharmacists and PSPTs, respectively (P = 0.55). Patient's EHRs contained a mean of 14.3 (95% CI, 11.2-17.5) and 16.3 (95% CI, 13.2-19.5) medications, prior to pharmacists and PSPTs obtaining an AMH, respectively (P = 0.41).

The mean time pharmacists and PSPTs needed to obtain an AMH was 58.5 (95% CI, 46.9-70.1) and 79.4 (95% CI, 59.1-99.8) minutes, respectively (P = 0.14). Summary time data per provider is reported in the Figure. The mean time for pharmacist supervision of technicians was 26 (95% CI, 14.9-37.1) minutes. Mean times of tasks and comparisons of these means times between providers are reported in the Table. The percent mean time for each task per patient for providers combined is also reported in the Table, in which utilizing the EHR was associated with the greatest percentage of time spent at 42.8% (95% CI, 37.4-48.2).

In the 18 cases for which a caregiver (or SNF medication list) was available, providers needed only 58.1 (95% CI, 44.1-72.1) minutes to obtain an AMH, as compared with 90.5 (95% CI, 67.9-113.1) minutes for the 12 cases lacking these resources (P = 0.02). We also found that among PSPTs, years of AMH experience were positively correlated with AMH time (coefficient of correlation 0.49, P = 0.04). No other studied variables were correlated with or associated with differential AMH times.

We estimated mean labor costs for pharmacists and PSPTs to obtain AMHs as $55.91 (95% CI, 44.9-67.0) and $45.00 (95% CI, 29.7-60.4) per patient, respectively (P = 0.32). In the latter case, $24.85 (95% CI, 14.3-35.4) of the $45.00 would be needed for pharmacist supervisory time. The labor cost for a PSPT-obtained AMH ($45.00) was the sum of the PSPT's

mean time (79.4 minutes) multiplied by technician wage data ($15.23/hour) and supervising pharmacist's mean time (26.0 minutes) multiplied by pharmacist wage data ($57.34/hour).

DISCUSSION

Although limited by sample size, we observed no difference in time or costs of obtaining AMHs between pharmacists and PSPTs. Several prior studies reported that pharmacists and technicians needed less time to obtain AMHs (20-40 minutes), as compared with our findings.[12-14] However, most prior studies used younger, healthier patients. Additionally, they used clinician self-reporting instead of third-person observer time and motion methodology. Indeed, the pharmacist times we observed in this study were consistent with prior findings[6] that used accepted third-person observer time and motion methodology.[10]

We observed more variation in time to obtain AMHs among PSPTs than among pharmacists. While variation may be at least in part to the greater number of technicians studied, variation also points to the need for training and oversight of PSPTs. Selection of PSPTs with prior experience interacting with patients and functioning with higher levels of autonomy, standardized training of PSPTs, and consistent dedication of trained PSPTs to AMH functions to maintain their skills, may help to minimize such variation.

Limitations include the use of a single center and a small sample size. As such, the study may be underpowered to demonstrate statistically significant differences between providers. Furthermore, 7 AMHs (19%) had to be excluded because complete task times were missing. This was exclusively because the workday of the research nurse ended before the AMH had been completed. Another limitation was that the tasks observed could have been dissected further to identify even more specific factors that could be targeted to decrease AMH times. We recommend that future studies be larger, investigate in more depth various factors associated with time needed to obtain AMHs, consider which patients would most likely benefit from PSPTs, and use a measure of value (eg, number of history errors prevented/dollar spent).

In summary, we found that PSPTs can obtain AMHs for similar cost to pharmacists. It will be especially important to know whether PSPTs maintain the accuracy documented in prior studies.[8-9] If that continues to be the case, we expect our findings to allow many hospitals to implement programs using PSPTs to obtain accurate AMHs.

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Nondirected Testing for Inpatients With Severe Liver Injury

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The "Things We Do for No Reason" series reviews practices which have become common parts of hospital care but which may provide little value to our patients. Practices reviewed in the TWDFNR series do not represent "black and white" conclusions or clinical practice standards, but are meant as a starting place for research and active discussions among hospitalists and patients. We invite you to be part of that discussion.

CASE REPORT

A 68-year-old woman with ischemic cardiomyopathy was admitted with abdominal cramping, diarrhea, and nausea, which had left her unable to keep food and liquids down for 2 days. She had been taking diuretics and had a remote history of intravenous drug use. On admission, she was afebrile and had blood pressure of 100/60 mm Hg and a heart rate of 100 bpm. Her extremities were cool and clammy. Blood test results showed an alanine aminotransferase (ALT) level of 1510 IU/L and an aspartate aminotransferase (AST) level of 1643 IU/L. The patient's clinician did not know her baseline ALT and AST levels and thought the best approach was to identify the cause of the transaminase elevation.

Severe acute liver injury (liver enzymes, >10 × upper limit of normal [ULN], usually 40 IU/L) is a common presentation among hospitalized patients. Between 1997 and 2015, 1.5% of patients admitted to our hospital had severe liver injury. In another large cohort of hospitalized patients,[1] 0.6% had an ALT level higher than 1000 IU/L (~20 × ULN). A precise diagnosis is often needed to direct appropriate therapy, and serologic tests are available for many conditions, both common and rare (Table). Given the relative ease of bundled blood testing, nondirected testing has emerged as a popular, if reflexive, strategy.[2-5] In this approach, clinicians evaluate each patient for the set of testable diseases all at once—in contrast to taking a directed, stepwise testing approach guided by the patient's history.

Use of nondirected testing is common in patients with severe acute liver injury. Of the 5795 such patients treated at our hospital between 2000 and 2015, within the same day of service 53% were tested for hepatitis C virus antibody, 38% for hemochromatosis (ferritin test), 28% for autoimmune hepatitis (antinuclear antibody test), and 15% for primary biliary cholangitis (antimitochondrial antibody test) by our clinical laboratory. Of the 5023 patients who had send-out tests performed for Wilson disease (ceruloplasmin), 81% were queried for hepatitis B virus infection, 76% for hepatitis C virus infection, 75% for autoimmune hepatitis, and 73.1% for hemochromatosis.[2] Similar trends were found for patients with severe liver injury tested for α_1-antitrypsin (AAT) deficiency.[3] In sum, these data showed that each patient with severe liver injury was tested out of concern about diseases with markedly different epidemiology and clinical presentations (Table).

WHY YOU MIGHT THINK NONDIRECTED TESTING IS HELPFUL

Use of nondirected testing may reflect perceived urgency, convenience, and thoroughness.[2-6] Alternatively, it may simply involve following a consultant's recommendations.[4] As severe acute liver injury is often associated with tremendous morbidity, clinicians seeking answers may perceive directed, stepwise testing as inappropriately slow given the urgency of the presentation; they may think that nondirected testing can reduce hospital length of stay.

WHY NONDIRECTED TESTING IS NOT HELPFUL

Nondirected testing is a problem for at least 4 reasons: limited benefit of reflexive testing for rare diseases, no meaningful impact on outcomes, false positives, and financial cost.

First, immediately testing for rare causes of liver disease is unlikely to benefit patients with severe liver injury. The underlying etiologies of severe liver injury are relatively well circumscribed (Table). Overall, 42% of patients with severe liver injury and 57% of those with an ALT level higher than 1000 IU/L have ischemic hepatitis.[7] Accounting for a significant percentage of severe liver injury cases are acute biliary obstruction (24%), drug-induced injury (10%-13%), and viral hepatitis (4%-7%).[1,8] Of the small subset of patients with severe liver injury that progresses to acute liver failure (ALF; encephalopathy, coagulopathy), 0.5% have autoimmune hepatitis and 0.1% have Wilson disease.[9] Furthermore, many patients are tested for AAT deficiency, hemochromatosis, and primary biliary cholangitis, but these are never causes of severe acute liver injury (Table).

Second, diagnosing a rarer cause of acute liver injury modestly earlier has no meaningful impact on outcome. Workup for more common etiologies can usually be completed

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TABLE. Causes of Severe Acute Liver Injury[a]

Disease	Population Estimate	Prevalence Among Those with Severe Liver Injury	Test
Ischemic hepatitis[7]	Unknown	42%	Physical exam, hemodynamics; if no evidence of hypoperfusion, consider ultrasonography and exclude viral hepatitis
Acute biliary obstruction[1,8]	~0.003%	24%	Ultrasonography, cross-sectional imaging
Drug-induced liver injury[9]	~0.002%	10%-13%	Exclude viral hepatitis, consider biopsy
Viral hepatitis[1,3,8]	~1%	4%-7%	Hepatitis C antibody/confirmed with PCR; hepatitis B surface antigen or core immunoglobulin M/confirmed with PCR
Autoimmune hepatitis[8,14]	0.001%	<0.5%	Antinuclear antibody, antismooth muscle antibody, immunoglobulin G; consider biopsy
Wilson disease[3]	0.03%	<0.1%	Ceruloplasmin <20 mg/dL; confirmed with urine copper concentration
Hemochromatosis[15]	0.1%	0%	Transferrin saturation >45%; confirmed with genetic test
Primary biliary cholangitis[16]	0.01%	0%	Antimitochondrial antibody; consider biopsy
Alpha-1 antitrypsin deficiency[2]	0.04%	0%	Alpha-1 antitrypsin level (<80 mg/dL) and confirmatory phenotype

[a]Severe acute liver injury = liver enzymes >10 times the upper limit of normal.

NOTE: Abbreviation: PCR, polymerase chain reaction.

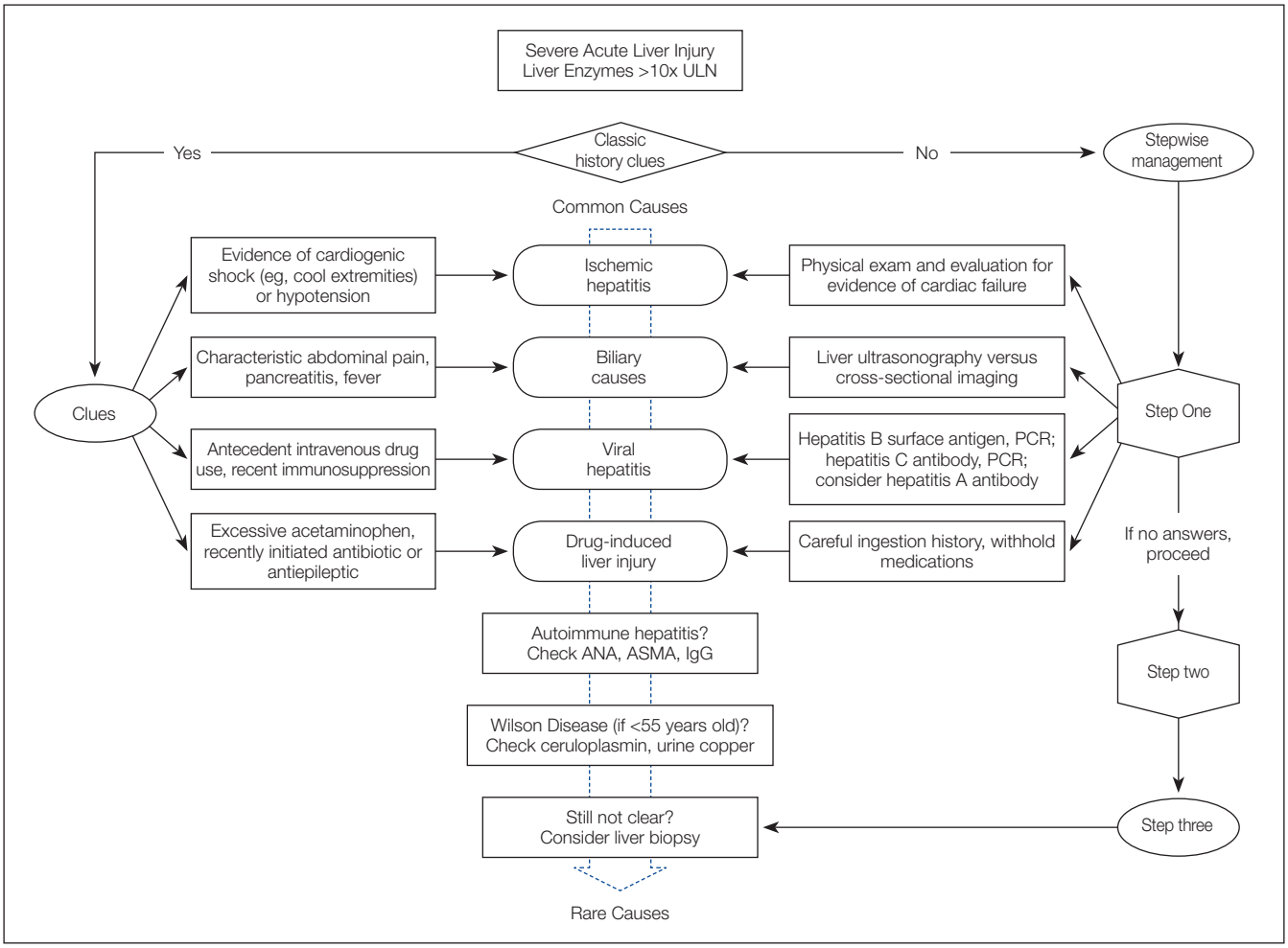

FIG. Pathway for evaluation of severe acute liver injury.

NOTE: Abbreviations: ANA, antinuclear antibody; ASMA, anti-smooth muscle antibody; IgG, immunoglobulin G; PCR, polymerase chain reaction; ULN, upper limit of normal.

within 2 or 3 days. This is true even for patients with ALF. Specific therapies generally are lacking for ALF, save for use of *N*-acetylcysteine for acetaminophen overdose and antiviral therapy for hepatitis B virus infection.[9,10] Furthermore, although effective therapies are available for both autoimmune hepatitis and Wilson disease, the potential benefit

stems from altering the longer term course of disease. Initial management, even for these rare conditions, is no different from that for other etiologies. Conversely, acute liver injury caused by ischemic hepatitis, biliary disease, or drug-induced liver injury requires swift corrective action. Even if normotensive, patients with ischemic hepatitis are often in cardiogenic shock and benefit from careful monitoring and critical care.[7] Patients with acute biliary obstruction may need therapeutic endoscopy. Last, patients with drug-induced liver injury benefit from immediate discontinuation of the offending drug.

Third, in the testing of patients with low pretest probabilities, false positives are common. For example, at our institution and at an institution in Austria, severe liver injury patients with a low ceruloplasmin level have a 95.1% to 98.1% chance of a false-positive result (they have a low ceruloplasmin level but do not have Wilson disease).[3,4] Furthermore, 91% of positive tests are never confirmed,[3] indicating either that clinicians never valued the initial test or that other diagnoses were much more likely. Even worse, as was the case in 65% of patients with low AAT levels,[2,3] genetic diagnoses were based on unconfirmed, potentially false-positive serologic tests.

Fourth, although the financial cost for each individual test is small, at the population level the cost of nondirected testing is significant. For example, although each reflects testing for conditions that do not cause acute liver injury, the costs of ferritin, AAT, and antimitochondrial antibody tests are $13, $16, and $37, respectively (Medicare/Medicaid reimbursements in 2016 $US).[11] About 1.5% of admitted patients are found to have severe liver injury. If this proportion holds true for the roughly 40 million discharges from US hospitals each year, then there would be an annual cost of about $40 million if all 3 tests were performed for each patient with severe liver injury. In addition, although nondirected testing may seem clinically expedient, there are no data suggesting it reduces length of stay. In fact, ceruloplasmin, AAT, and many other tests are sent to external laboratories and are unlikely to be returned before discharge. If clinicians delay discharge for results, then nondirected testing would increase rather than decrease length of stay.

WHAT YOU SHOULD DO INSTEAD

In this era of increasing cost-consciousness, nondirected testing has escaped relatively unscathed. Indeed, nondirected testing is prevalent, yet has pitfalls similar to those of serologic testing (eg, vasculitis or arthritis,[6] acute renal injury, infectious disease[12]). The alternative is deliberate, empirical, patient-centered testing that is attentive to the patient's presentation and the harms of false positives. The idea is to select tests for each patient with acute liver injury according to presentation and the most likely corresponding diagnoses (Table, Figure).

The patient in our case report had a history suggestive of ischemic hepatitis, which requires urgent evaluation, and management of potential decompensated heart failure. However, given her history of intravenous drug use, viral hepatitis must be excluded. In addition, a careful history of medication and ingestion should be obtained. Testing should start with physical examination (assessing for hypoperfusion), consideration of abdominal ultrasonography with Doppler evaluation, and serologic testing for viral hepatitis. Testing for rare diseases should be performed only after these more common diseases have been excluded.

The "one-stop shopping" in providers' electronic order entry systems makes it too easy to over-order tests. Fortunately, these systems' simple and effective decision supports can force pauses in the ordering process, create barriers to waste, and provide education about test characteristics and costs.[4,5,13] Our medical center's volume of ceruloplasmin orders decreased by 80% after a change was made to its ordering system; the ordering of a ceruloplasmin test is now interrupted by a pop-up screen that displays test characteristics and an option to continue or cancel the order.[4,5] Hospitals should consider implementing clinical decision supports in this area. Successful interventions provide electronic rather than paper-based support as part of the clinical workflow, during the ordering process, and recommendations rather than assessments.[13]

RECOMMENDATIONS

- For each patient with severe acute liver injury, select tests on the basis of the presentation (Figure). Testing for rare diseases should be performed only after common diseases have been excluded.
- Avoid testing for hemochromatosis (iron indices, genetic tests), AAT deficiency (AAT levels or phenotypes), and primary biliary cholangitis (antimitochondrial antibodies) in patients with severe acute liver injury.
- Consider implementing decision supports that can curb nondirected testing in areas in which it is common.

CONCLUSION

Nondirected testing is associated with false positives and increased costs in the evaluation and management of severe acute liver injury. The alternative is deliberate, epidemiologically and clinically driven directed testing. Electronic ordering system decision supports can be useful in curtailing nondirected testing.

Disclosure: Nothing to report.

Do you think this is a low-value practice? Is this truly a "Thing We Do for No Reason"? Let us know what you do in your practice and propose ideas for other "Things We Do for No Reason" topics. Please join in the conversation online at Twitter (#TWDFNR)/Facebook and don't forget to "Like It" on Facebook or retweet it on Twitter.

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Forging Ahead

The approach to clinical conundrums by an expert clinician is revealed through the presentation of an actual patient's case in an approach typical of a morning report. Similarly to patient care, sequential pieces of information are provided to the clinician, who is unfamiliar with the case. The focus is on the thought processes of both the clinical team caring for the patient and the discussant.

This icon represents the patient's case. Each paragraph that follows represents the discussant's thoughts.

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A 45-year-old woman presented to the emergency department with 2 days of generalized, progressive weakness. Her ability to walk and perform daily chores was increasingly limited. On the morning of her presentation, she was unable to stand up without falling.

A complaint of weakness must be classified as either functional weakness related to a systemic process or true neurologic weakness from dysfunction of the central nervous system (eg, brain, spinal cord) or peripheral nervous system (eg, anterior horn cell, nerve, neuromuscular junction, or muscle). More information on her clinical course and a detailed neurologic exam will help clarify this key branch point.

She was 2 weeks status-post laparoscopic Roux-en-Y gastric bypass and gastric band removal performed in Europe. Immediately following surgery, she experienced abdominal discomfort and nausea with occasional nonbloody, nonbilious emesis, attributed to expected postoperative anatomical changes. She developed a postoperative pneumonia treated with amoxicillin-clavulanate. She tolerated her flight back to the United States, but her abdominal discomfort persisted and she had minimal oral intake due to her nausea.

Functional weakness may stem from hypovolemia from insufficient oral intake, anemia related to the recent surgery, electrolyte abnormalities, chronic nutritional issues associated with obesity and weight-reduction surgery, and pneumonia. Prolonged air travel, obesity, and recent surgery place her at risk for venous thromboembolism, which may manifest as reduced exercise tolerance. Nausea, vomiting, and abdominal pain persisting for 2 weeks after a Roux-en-Y gastric bypass surgery raises several concerns, including gastric remnant distension (although hiccups are often prominent); stomal stenosis, which typically presents several weeks after surgery; marginal ulceration; or infection at the surgical site or from an anastomotic leak. She may also have a surgery- or medication-related myopathy.

The patient had a history of obesity, hypertension, hyperlipidemia, migraine headaches, and nonalcoholic steatohepatitis. Four years previously, she had undergone gastric banding complicated by band migration and ulceration at the banding site. Her medications were amlodipine, losartan, ranitidine, acetaminophen, and nadroparin for venous thromboembolism prophylaxis during her flight. She denied alcohol, tobacco, or illicit drug use. On further questioning, she reported diaphoresis, mild dyspnea, loose stools, and a sensation of numbness and "heaviness" in her arms. Her abdominal pain was limited to the surgical incision and was controlled with acetaminophen. She denied fevers, cough, chest pain, diplopia, or dysphagia.

Heaviness in both arms could result from an acutely presenting myopathic or neuropathic process, while the coexistence of numbness suggests a sensorimotor polyneuropathy. Obesity and gastric bypass surgery increase her nutritional risk, and thiamine deficiency may present as an acute axonal polyneuropathy (ie, beriberi). Unlike vitamin B12 deficiency, which may take years to develop, thiamine deficiency can present within 4 weeks of gastric bypass surgery. Her dyspnea may be a manifestation of diaphragmatic weakness, although her ostensibly treated pneumonia or as of yet unproven postoperative anemia may be contributing. Chemoprophylaxis mitigates her risk of venous thromboembolism, which is, nonetheless, unlikely to account for the gastrointestinal symptoms and upper extremity weakness. If she is continuing to take amlodipine and losartan but has become volume-depleted, hypotension may be contributing to the generalized weakness.

Physical examination revealed an obese, pale and diaphoretic woman. Her temperature was 36.9°C, heart

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rate 77 beats per minute, blood pressure 158/90 mm Hg, respiratory rate 28 breaths per minute, and O_2 saturation 99% on ambient air. She had no cervical lymphadenopathy and a normal thyroid exam. There were no murmurs on cardiac examination, and jugular venous pressure was estimated at 10 cm of water. Her lung sounds were clear. Her abdomen was soft, nondistended, with localized tenderness and fluctuance around the midline surgical incision with a small amount of purulent drainage. She was alert and oriented to name, date, place, and situation. Cranial nerves II through XII were grossly intact. Strength was 4/5 in bilateral biceps, triceps and distal hand and finger extensors, 3/5 in bilateral deltoids. Strength in hip flexors was 4/5 and it was 5/5 in distal lower extremities. Sensation was intact to pinprick in upper and lower extremities. Biceps reflexes were absent; patellar and ankle reflexes were 1+ and symmetric. The remainder of the physical exam was unremarkable.

The patient has symmetric proximal muscle weakness with upper extremity predominance and preserved strength in her distal lower extremities. A myopathy could explain this pattern of weakness, further substantiated by absent reflexes and reportedly intact sensation. Subacute causes of myopathy include hypokalemia, hyperkalemia, toxic myopathies from medications, or infection-induced rhabdomyolysis. However, she does not report muscle pain, and the loss of reflexes is faster than would be expected with a myopathy. A more thorough sensory examination would inform the assessment of potential neuropathic processes. Guillain-Barré syndrome (GBS) is possible; it most commonly presents as an ascending, distally predominant acute inflammatory demyelinating polyneuropathy (AIDP), although her upper extremity weakness predominates and there are no clear sensory changes. It remains to be determined how her wound infection might relate to her overall presentation.

Her white blood cell count was 12,600/μL (reference range: 3,400-10,000/μL), hemoglobin was 10.2 g/dL, and platelet count was 698,000/μL. Mean corpuscular volume was 86 fL. Serum chemistries were: sodium 138 mEq/L, potassium 3.8 mEq/L, chloride 106 mmol/L, bicarbonate 15 mmol/L, blood urea nitrogen 5 mg/dL, creatinine 0.65 mg/dL, glucose 125 mg/dL, calcium 8.3 mg/dL, magnesium 1.9 mg/dL, phosphorous 2.4 mg/dL, and lactate 1.8 mmol/L (normal: < 2.0 mmol/L). Creatinine kinase (CK), liver function tests, and coagulation panel were normal. Total protein was 6.4 g/dL, and albumin was 2.7 g/dL. Venous blood gas was: pH 7.39 and PCO_2 25 mmHg. Urinalysis revealed ketones. Blood and wound cultures were sent for evaluation. A chest x-ray was unremarkable. An electrocardiogram showed normal sinus rhythm. Computed tomography (CT) of the abdomen and pelvis revealed a multiloculated rim-enhancing fluid collection in the anterior abdominal wall (Figure 1).

She does not have any notable electrolyte derangements that would account for her weakness, and the normal creatinine kinase lowers the probability of a myopathy and excludes rhabdomyolysis. Progression of weakness from proximal to distal muscles in a symmetric fashion is consistent with botulism, and she has an intra-abdominal wound infection that could be harboring *Clostridium botulinum*. Nonetheless, the normal cranial nerve exam and the rarity of botulism occurring with surgical wounds argue against this diagnosis. She should receive intravenous (IV) thiamine for the possibility of beriberi. A lumbar puncture should be performed to assess for albuminocytologic dissociation, which can be seen in patients with GBS.

The patient received high-dose IV thiamine, IV vancomycin, IV piperacillin-tazobactam, and acetaminophen. Over the subsequent 4 hours, her anion gap acidosis worsened. She declined arterial puncture. Repeat venous blood gas was: pH 7.22, PCO2 28 mmHg, and bicarbonate 11 mmol/L. Lactate and glucose were normal. Serum osmolarity was 292 mmol/kg (reference range: 283-301 mmol/kg). She was started on an IV sodium bicarbonate infusion without improvement in her acidemia.

An acute anion gap metabolic acidosis suggests a limited differential diagnosis that includes lactic acidosis, D-lactic acidosis, severe starvation ketoacidosis, acute renal failure, salicylate, or other drug or poison ingestion. Starvation ketoacidosis may be contributing, but a bicarbonate value this low would be unusual. There is no history of alcohol use or other ingestions, and the normal serum osmolality and low osmolal gap (less than 10 mOsm/kg) argue against a poisoning with ethanol, ethylene glycol, or methanol. The initial combined anion gap metabolic acidosis and respiratory alkalosis is consistent with salicylate toxicity, but she does not report aspirin ingestion. Acetaminophen use in the setting of malnutrition or starvation physiology

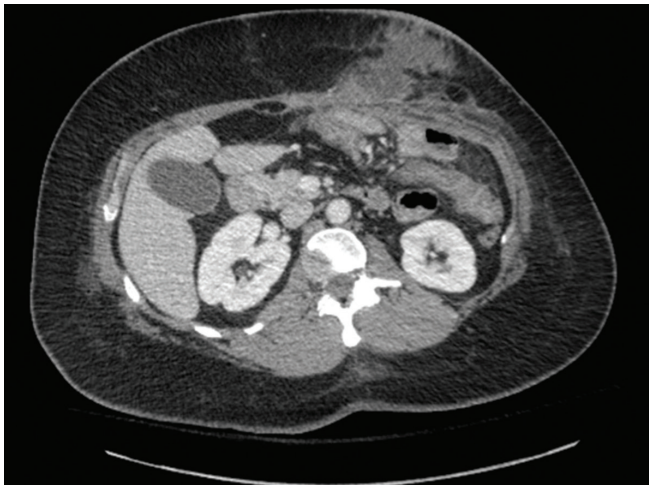

FIG. 1. Multiloculated rim enhancing collection in the anterior abdominal wall. The majority of this collection is exterior to the rectus muscles; however, intraabdominal extension is not entirely excluded.

raises the possibility of 5-oxoproline accumulation.

Routine serum lactate does not detect D-lactate, which is produced by colonic bacteria and has been reported in short bowel syndrome and following intestinal bypass surgery. This may occur weeks to months after intestinal procedures, following ingestion of a heavy carbohydrate load, and almost invariably presents with altered mental status and increased anion gap metabolic acidosis, although generalized weakness has been reported.

A surgical consultant drained her wound infection. Fluid Gram stain was negative. D-lactate, salicylate and acetaminophen levels were undetectable. Thiamine pyrophosphate level was 229 nmol/L (reference range: 78-185 nmol/L). Acetaminophen was discontinued and N-acetylcysteine infusion was started for possible 5-oxoprolinemia. Her anion gap acidosis rapidly improved. Twelve hours after admission, she reported sudden onset of blurry vision. Her vital signs were: temperature 37°C, heart rate 110 beats per minute, respiratory rate 40 breaths per minute, blood pressure 168/90, and oxygen saturation 100% on ambient air. Telemetry showed ventricular bigeminy. On examination, she was unable to abduct her right eye; muscle strength was 1/5 in all extremities; biceps, ankle, and patellar reflexes were absent.

Her neurological deficits have progressed over hours to near complete paralysis, asymmetric cranial nerve paresis, and areflexia. Although botulism can cause blurred vision and absent deep tendon reflexes, patients almost always have symmetrical bulbar findings followed by descending paralysis. Should the "numbness" in her arms reported earlier represent undetected sensory deficits, this, too would be inconsistent with botulism.

A diagnosis of GBS ties together several aspects of her presentation and clinical course. Several variants show different patterns of weakness and may involve cranial nerves. Her tachypnea and dyspnea are concerning signs of potential impending respiratory failure. The ventricular bigeminy and mild hypertension could represent autonomic dysfunction that is seen in many cases of GBS.

She was intubated for airway protection. Computed tomography angiography and magnetic resonance imaging of her brain were normal. Cerebral spinal fluid analysis obtained through lumbar puncture showed the following: white blood cell count 3/μL, red blood cell count 11/μL, protein 63 mg/dL (reference range: 15-60mg/dL), and glucose 128 mg/dL (reference range: 40-80mg/dL).

The lumbar puncture is consistent with GBS given the slightly elevated protein and cell count well below 50/μL. Given the severity of her symptoms, treatment with IV immunoglobulin or plasmapheresis should be initiated. Nerve conduction studies (NCS) and electromyography (EMG) are indicated for diagnostic confirmation.

EMG and NCS revealed a severe sensorimotor polyneuropathy with demyelinating features including a conduction block at a noncompressible site, consistent with AIDP. Left sural nerve biopsy confirmed acute demyelinating and mild axonal neuropathy (Figure 2). On hospital day 2, treatment with IV immunoglobulins (IVIG) was initiated; however, she developed anaphylaxis following her second administration and subsequently received plasmapheresis. A tracheostomy was performed for respiratory muscle weakness, and she was discharged to a nursing facility. C. botulinum cultures from the wound eventually returned negative. Following her hospitalization, a serum 5-oxoproline level sent 10 hours after admission returned as elevated, confirming the additional diagnosis of 5-oxoprolinemia. On follow-up, she can sit up and feed herself without assistance, and her gait continues to improve with physical therapy.

DISCUSSION

This patient presented with rapidly progressive weakness that developed in the 2 weeks following bariatric surgery. In the postsurgical setting, patient complaints of weakness are commonly encountered and can pose a diagnostic challenge. Asthenia (ie, general loss of strength or energy) is frequently reported in the immediate postoperative period, and may result from the stress of surgery, pain, deconditioning, or infection. This must be distinguished from true neurologic weakness, which results from dysfunction of the brain, spinal cord, nerve, neuromuscular junction, or muscle. The initial history can help elucidate the inciting events such as preceding surgery, infections or ingestions, and can also categorize the pattern of weakness. The neurologic examination can localize the pathology within the neuraxis. EMG and NCS can distinguish neuropathy from radiculopathy, and

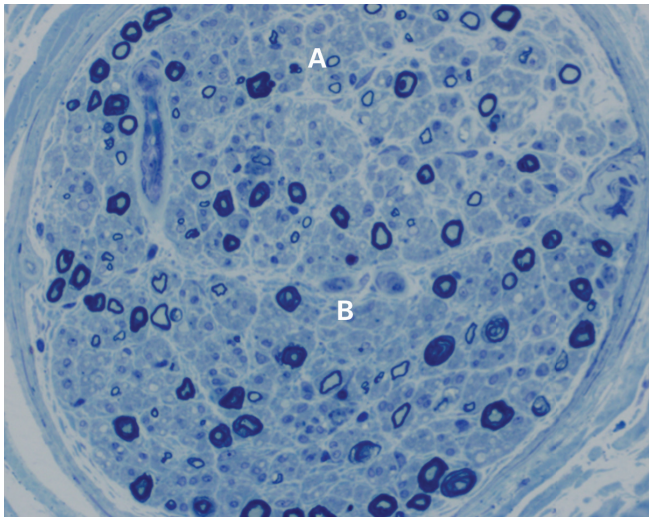

FIG. 2. Sural nerve biopsy. Toluidine blue stained cross section of nerve sheath demonstrating features of demyelinating (significant thinning of myelin coat seen as ring-shaped dark blue structures, A) and axonal (generalized loss of nerve axons seen as areas with complete loss of myelinated structures, B) neuropathy.

categorize the process as axonal, demyelinating, or mixed. In this case, the oculomotor weakness, sensory abnormalities and areflexia signaled a severe sensorimotor polyneuropathy, and EMG/NCS confirmed a demyelinating process consistent with GBS.

Guillain-Barré syndrome is an acute, immune-mediated polyneuropathy. Patients with GBS often present with a preceding respiratory or diarrheal illness; however, the stress of a recent surgery can serve as an inciting event. The syndrome, acute postgastric reduction surgery (APGARS) neuropathy, was introduced in the literature in 2002, describing 3 patients who presented with progressive vomiting, weakness, and hyporeflexia following bariatric surgery.[1] The term has been used to describe bariatric surgery patients who developed postoperative quadriparesis, cranial nerve deficits, and respiratory compromise.[2] Given the clinical heterogeneity in the literature with relation to APGARS, it is probable that the cases described could result from multiple etiologies. While GBS is purely immune-mediated and can be precipitated by the stress of surgery itself, postbariatric surgery patients are susceptible to many nutritional deficiencies that can lead to similar presentations.[3] For example, thiamine (vitamin B1) and cobalamin (vitamin B12) deficiencies cause distinct postbariatric surgery neuropathies.[4] Thiamine deficiency may manifest weeks to months after surgery and can rapidly progress, whereas cobalamin deficiency generally develops over 3 to 5 years. Both of these syndromes demonstrate an axonal pattern of nerve injury on EMG/NCS, in contrast to the demyelinating pattern typically seen in GBS. In addition, bariatric surgery patients are at higher risk for copper deficiency, which usually presents as a myeloneuropathy with subacute gait decline and upper motor neuron signs including spasticity.

Although GBS classically presents with symmetric ascending weakness and sensory abnormalities, it may manifest in myriad ways. Factors influencing the presentation include the types of nerve fibers involved (motor, sensory, cranial or autonomic), the predominant mode of injury (axonal vs demyelinating), and the presence or absence of alteration in consciousness.[5] The most common form of GBS is AIDP. The classic presentation involves paresthesias in the fingertips and toes followed by lower extremity weakness that ascends over hours to days to involve the arms and potentially the muscles of respiration. A minority of patients with GBS first experience weakness in the upper extremities or facial muscles, and oculomotor involvement is rare.[5] Pain is common and often severe.[6] Dysautonomia affects most patients with GBS and may manifest as labile blood pressure or arrhythmias.[5] Several variant GBS presentation patterns have been described, including acute motor axonal neuropathy, a pure motor form of GBS; ophthalmoplegia, ataxia, and areflexia in Miller Fisher syndrome; and alteration in consciousness, hyperreflexia, ataxia, and ophthalmoparesis in Bickerstaff's brain stem encephalitis.[5]

Patients with GBS can progress rapidly to respiratory failure. Serial neurologic exams may signal the diagnosis and inform triage to the appropriate level of care. Measurement of bedside pulmonary function, including mean inspiratory force and functional vital capacity, help to determine if there is weakness of diaphragmatic muscles. Patients with signs or symptoms of diaphragmatic weakness require monitoring in an intensive care unit and potentially early intubation. Treatment with IVIG or plasmapheresis has been found to hasten recovery from GBS, including earlier improvement in muscle strength and a reduced need for mechanical ventilation.[7] Treatment selection is based on available resources as both modalities are felt to be equivalent. The majority of patients with GBS make a full recovery over a period of weeks to months, although many have persistent motor weakness. Despite immunotherapy, up to 20% of patients remain severely disabled and approximately 5% die.[8] Advanced age, rapid progression of weakness over a period of less than 72 hours, need for mechanical ventilation, and absent compound muscle action potentials on NCS are all associated with prolonged and incomplete recovery.[9]

This patient developed respiratory failure within 12 hours of hospitalization, prior to being diagnosed with GBS. Even in that short time, the treating clinicians encountered a series of clinical diversions. The initial proximal pattern of muscle weakness suggested a possible myopathic process; the wound infection introduced the possibility of botulism; obesity and recent bariatric surgery triggered concern for thiamine deficiency; and the anion gap acidosis from 5-oxoprolinemia created yet another clinical detour. While the path from presentation to diagnosis is seldom a straight line, when faced with rapidly progressive weakness, it is paramount to forge ahead with an efficient diagnostic evaluation and timely therapeutic intervention.

KEY TEACHING POINTS

- A complaint of general weakness requires distinction between asthenia (ie, general loss of strength or energy) and true neuromuscular weakness from dysfunction of the brain, spinal cord, nerve, neuromuscular junction, and/or muscle.
- Guillain-Barré syndrome may present in a variety of atypical fashions not limited to ascending, distally predominant weakness.
- Acute postgastric reduction surgery neuropathy should be considered in patients presenting with weakness, vomiting, or hyporeflexia after bariatric surgery.
- Acute inflammatory demyelinating polyneuropathy may rapidly progress to respiratory failure, and warrants serial neurologic examinations, monitoring of pulmonary function, and an expedited diagnostic evaluation.

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Health Information Exchange in US Hospitals: The Current Landscape and a Path to Improved Information Sharing

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Electronic health information exchange (HIE) was a foundational goal of the 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act, but 7 years later we are far from a nationally interoperable health system. Connected electronic health records have the potential to enable fast access to a wealth of clinical data and can deliver a solution to the highly fragmented US healthcare system. In this review, we present a history and background of HIE, including its potential to deliver significant cost savings to the healthcare system. We examine the key components of HIE, including exchanges, the mechanism, and options available to providers. Health information exchange faces significant challenges, ranging from technical issues to lack of a clear goal, but continued policy initiatives and new technologies represent a promising path to providing clinicians with routine, electronic patient data. *Journal of Hospital Medicine* 2017;12:193-198. © 2017 Society of Hospital Medicine

The US healthcare system is highly fragmented, with patients typically receiving treatment from multiple providers during an episode of care and from many more providers over their lifetime.[1,2] As patients move between care delivery settings, whether and how their information follows them is determined by a haphazard and error-prone patchwork of telephone, fax, and electronic communication channels.[3] The existence of more robust electronic communication channels is often dictated by factors such as which providers share the same electronic health record (EHR) vendor rather than which providers share the highest volume of patients. As a result, providers often make clinical decisions with incomplete information, increasing the chances of misdiagnosis, unsafe or suboptimal treatment, and duplicative utilization.

Providers across the continuum of care encounter challenges to optimal clinical decision-making as a result of incomplete information. These are particularly problematic among clinicians in hospitals and emergency departments (EDs). Clinical decision-making in EDs often involves urgent and critical conditions in which decisions are made under pressure. Time constraints limit provider ability to find key clinical information to accurately diagnose and safely treat patients.[4-6] Even for planned inpatient care, providers are often unfamiliar with patients, and they make safer decisions when they have full access to information from outside providers.[7,8]

Transitions of care between hospitals and primary care settings are also fraught with gaps in information sharing. Clinical decisions made in primary care can set patients on treatment trajectories that are greatly affected by the quality of information available to the care team at the time of initial diagnosis as well as in their subsequent treatment. Primary care physicians are not universally notified when their patients are hospitalized and may not have access to detailed information about the hospitalization, which can impair their ability to provide high quality care.[9-11]

Widespread and effective electronic health information exchange (HIE) holds the potential to address these challenges.[3] With robust, interconnected electronic systems, key pieces of a patient's health record can be electronically accessed and reconciled during planned and unplanned care transitions. The concept of HIE is simple—make all relevant patient data available to the clinical care team at the point of care, regardless of where that information was generated. The estimated value of nationwide interoperable EHR adoption suggests large savings from the more efficient, less duplicative, and higher quality care that likely results.[12,13]

There has been substantial funding and activity at federal, state, and local levels to promote the development of HIE in the US. The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act has the specific goal of accelerating adoption and use of certified EHR technology coupled with the ability to exchange clinical information to support patient care.[14] The HITECH programs supported specific types of HIE that were believed to be particularly critical to improving patient care and included them in the federally-defined criteria for Meaningful Use (MU) of EHRs (ie, providers receive financial incentives for achieving specific objectives). The MU criteria evolve, moving from data capture in stage 1 to improved patient outcomes in stage 3.[15] The HIE criteria focus on sending and receiving summary-of-care records during care transitions.

Despite the clear benefits of HIE and substantial support stated in policy initiatives, the spread of national HIE has been slow. Today, HIE in the US is highly heterogeneous: as

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TABLE. Four Key Dimensions of Health Information Exchange

Dimensions	Options	Implications
What is exchanged?	Wide range of possible data elements and documents. Range from individual data elements to full patient records, but intermediate summary of care records most common.	Sharing only certain data elements may not solve issues caused by lack of clinical data.
Who is exchanging?	Providers in different organizations Providers within the same organization on different EHR systems.	Providers within the same health system may experience many of the same gaps in clinical data as those in two different organizations. However, because patients move across different health systems, there is a need to share both within and across organizations.
How is exchange occurring?	Data are directly pushed to another provider organization. Data are queried by the provider and pulled from the sending organization	Different methods of exchange work better for different use cases. Push exchange is useful for planned transitions of care, while pull exchange is valuable in emergency situations.
Who governs exchange?	Enterprise HIE: availability determined by provider organization affiliations. Vendor HIE: availability determined by EHR vendor choice. Community HIE: availability determined by geographic region.	Enterprise and vendor HIE networks exclude certain providers and may not be in the best interest of the patient. Community HIE networks are not available in all locations, and providers may not want to share patient data with direct competitors.

NOTE: Abbreviations: EHR, electronic health record; HIE, health information exchange.

a result of multiple federal-, state-, community-, enterprise- and EHR vendor-level efforts, only some provider organizations are able to engage in HIE with the other provider organizations with which they routinely share patients. In this review, we offer a framework and a corresponding set of definitions to understand the current state of HIE in the US. We describe key challenges to HIE progress and offer insights into the likely path to ensure that clinicians have routine, electronic access to patient information.

FOUR KEY DIMENSIONS OF HEALTH INFORMATION EXCHANGE

While the concept of HIE is simple—electronic access to clinical information across healthcare settings—the operationalization of HIE occurs in many different ways.[16] While the terms "health information exchange" and "interoperability" are often used interchangeably, they can have different meanings. In this section, we describe 4 important dimensions that serve as a framework for understanding any given effort to enable HIE (Table).

(1) What Is Exchanged? Types of Information

The term "health information exchange" is ambiguous with respect to the type(s) of information that are accessible. Health information exchange may refer to the process of 2 providers electronically sharing a wide range of data, from a single type of information (eg, lab test results), summary of care records, to complete patient records.[17] Part of this ambiguity may stem from uncertainty about the scope of information that should be shared, and how this varies based on the type of clinical encounter. For example, critical types of information in the ED setting may differ from those relevant to a primary care team after a referral. While the ability to access only particular types of information will not address all information gaps, providing access to complete patient records may result in information overload that inhibits the ability to find the subset of information relevant in a given clinical encounter.

(2) Who is Exchanging? Relationship Between Provider Organizations

The types of information accessed electronically are effectively agnostic to the relationship between the provider organizations that are sharing information. Traditionally, HIE has been considered as information that is electronically shared among 2 or more unaffiliated organizations. However, there is increasing recognition that some providers may not have electronic access to all information about their patients that exists within their organization, often after a merger or acquisition between 2 providers with different EHR systems.[18,19] In these cases, a primary care team in a large integrated delivery system may have as many information gaps as a primary care team in a small, independent practice. Fulfilling clinical information needs may require both intra- and interorganizational HIE, which complicates the design of HIE processes and how the care team approaches incorporating information from both types of organizations into their decision-making. It is also important to recognize that some provider organizations, particularly small, rural practices, may not have the information technology and connectivity infrastructure required to engage in HIE.

(3) How Is Information Exchanged? Types of Electronic Access: Push vs Pull Exchange

To minimize information gaps, electronic access to information from external settings needs to offer both "push" and "pull" options. Push exchange, which can direct information electronically to a targeted recipient, works in scenarios in which there is a known information gap and known information source. The classic use for push exchange is care coordination, such as primary care physician-specialist referrals or hospital-primary care physician transitions postdischarge. Pull exchange accommodates scenarios in which there is a known information gap but the source(s) of information are unknown; it requires that clinical care teams search for and locate the clinical information that exists about the patient in external settings. Here, the classic use is emergency care

in which the care team may encounter a new patient and want to retrieve records.

Widespread use of provider portals that offer view-only access into EHRs and other clinical data repositories maintained by external organizations complicate the picture. Portals are commonly used by hospitals to enable community providers to view information from a hospitalization.[21] While this does not fall under the commonly held notion of HIE because no exchange occurs, portals support a pull approach to accessing information electronically among care settings that treat the same patients but use different EHRs.

Regardless of whether information is pushed or pulled, this may happen with varying degrees of human effort. This distinction gives rise to the difference between HIE and interoperability. Health information exchange reflects the ability of EHRs to exchange information, while interoperability additionally requires that EHRs be able to use exchanged information. From an operational perspective, the key distinction between HIE and interoperability is the extent of human involvement. Health information exchange requires that a human read and decide how to enter information from external settings (eg, a chart in PDF format sent between 2 EHRs), while interoperability enables the EHR that receives the information to understand the content and automatically triage or reconcile information, such as a medication list, without any human action.[21] Health information exchange, therefore, relies on the diligence of the receiving clinician, while interoperability does not.

(4) What Governance Entity Defines the "Rules" of Exchange?

When more than 1 provider organization shares patient-identified data, a governance entity must specify the framework that governs the exchange. While the specifics of HIE governance vary, there are 3 predominant types of HIE networks, based on the type of organization that governs exchange: enterprise HIE networks, EHR vendor HIE networks or community HIE networks.

Enterprise HIE networks exist when 1 or more provider organizations electronically share clinical information to support patient care with some restriction, beyond geography, that dictates which organizations are involved. Typically, restrictions are driven by strategic, proprietary interests.[22,23] Although broad-based information access across settings would be in the best interest of the patient, provider organizations are sensitive to the competitive implications of sharing data and may pursue such sharing in a strategic way.[24] A common scenario is when hospitals choose to strategically affiliate with select ambulatory providers and exclusively exchange information with them. This should facilitate better care coordination for patients shared by the hospital and those providers but can also benefit the hospital by increasing the referrals from those providers. While there is little direct evidence quantifying the extent to which this type of strategic sharing takes place, there have been anecdotal reports as well as indirect findings that for-profit hospitals in competitive markets are less likely to share patient data.[19,25]

EHR vendor HIE networks exist when exchange occurs within a community of provider organizations that use an EHR from the same vendor. A subset of EHR vendors have made this capability available; EPIC's CareEverywhere solution[27] is the best-known example. Providers with an EPIC EHR are able to query for and retrieve summary of care records and other documents from any provider organization with EPIC that has activated this functionality. There are also multivendor efforts, such as CommonWell[27] and the Sequoia Project's Carequality collaborative,[28] which are initiatives that seek to provide a common interoperability framework across a diverse set of stakeholders, including provider organizations with different EHR systems, in a similar fashion to HIE modules like CareEverywhere. To date, growth in these cross-vendor collaborations has been slow, and they have limited participation. While HIE networks that involve EHR vendors are likely to grow, it is difficult to predict how quickly because they are still in an early phase of development, and face nontechnical barriers such as patient consent policies that vary between providers and across states.

Community HIE networks—also referred to as health information organizations (HIOs) or regional health information organizations (RHIOs)—exist when provider organizations in a community, frequently state-level organizations that were funded through HITECH grants,[14] set up the technical infrastructure and governance approach to engage in HIE to improve patient care. In contrast to enterprise or vendor HIE networks that have pursued HIE in ways that appear strategically beneficial, the only restriction on participation in community and state HIE networks is usually geography because they view information exchange as a public good. Seventy-one percent of hospital service areas (HSAs) are covered by at least 1 of the 106 operational HIOs, with 309,793 clinicians (licensed prescribers) participating in those exchange networks. Even with early infusions of public and other grant-funding, community HIE networks have experienced significant challenges to sustained operation, and many have ceased operating.[29]

Thus, for any given provider organization, available HIE networks are primarily shaped by 3 factors:

1. *Geographic location*, which determines the available community and state HIE networks (as well as other basic information technology and connectivity infrastructure); providers located outside the service areas covered by an operational HIE have little incentive to participate because they do not connect them to providers with whom they share patients. Providers in rural areas may simply not have the needed infrastructure to pursue HIE.
2. *Type of organization* to which they belong, which determines the available enterprise HIE networks; providers who are not members of large health systems may be excluded from participation in these types of networks.
3. *EHR vendor*, which determines whether they have access to an EHR vendor HIE network.

ONGOING CHALLENGES

Despite agreement about the substantial potential of HIE to reduce costs and increase the quality of care delivered across a broad range of providers, HIE progress has been slow. While HITECH has successfully increased EHR adoption in hospitals and ambulatory practices,[30] HIE has lagged. This is largely because many complex, intertwined barriers must be addressed for HIE to be widespread.

Lack of a Defined Goal

The cost and complexity associated with the exchange of a single type of data (eg, medications) is substantially less than the cost and complexity of sharing complete patient records. There has been little industry consensus on the target goal—do we need to enable sharing of complete patient records across all providers, or will summary of care records suffice? If the latter, as is the focus of the current MU criteria, what types of information should be included in a summary of care record, and should content and/or structure vary depending on the type of care transition? While the MU criteria require the exchange of a summary of care record with defined data fields, it remains unclear whether this is the end state or whether we should continue to push towards broad-based sharing of all patient data as structured elements. Without a clear picture of the ideal end state, there has been significant heterogeneity in the development of HIE capabilities across providers and vendors, and difficulty coordinating efforts to continue to advance towards a nationwide approach. Addressing this issue also requires progress to define HIE usability, that is, how information from external organizations should be presented and integrated into clinical workflow and clinical decisions. Currently, where HIE is occurring and clinicians are receiving summary of care records, they find them long, cluttered, and difficult to locate key information.

Numerous, Complex Barriers Spanning Multiple Stakeholders

In the context of any individual HIE effort, even after the goal is defined, there are a myriad of challenges. In a recent survey of HIO efforts, many identified the following barriers as substantially impeding their development: establishing a sustainable business model, lack of funding, integration of HIE into provider workflow, limitations of current data standards, and working with governmental policy and mandates.[30] What is notable about this list is that the barriers span an array of areas, including financial incentives and identifying a sustainable business model, technical barriers such as working within the limitations of data standards, and regulatory issues such as state laws that govern the requirements for patient consent to exchange personal health information. Overcoming any of these issues is challenging, but trying to tackle all of them simultaneously clearly reveals why progress has been slow. Further, resolving many of the issues involve different groups of stakeholders. For example, implementing appropriate patient consent procedures can require engaging with and harmonizing the regulations of multiple states, as well as the Health Insurance Portability and Accountability Act (HIPAA) and regulations specific to substance abuse data.

Weak or Misaligned Incentives

Among the top barriers to HIE efforts are those related to funding and lack of a sustainable business model. This reflects the fact that economic incentives in the current market have not promoted provider engagement in HIE. Traditional fee-for-service payment structures do not reward providers for avoiding duplicative care.[31] Further, hospitals perceive patient data as a "key strategic asset, tying physicians and patients to their organization,"[24] and are reluctant to share data with competitors. Compounding the problem is that EHR vendors have a business interest in using HIE as a lever to increase revenue. In the short-term, they can charge high fees for interfaces and other HIE-related functionality. In the long-run, vendors may try to influence provider choice of system by making it difficult to engage in cross-vendor exchange.[32] Information blocking—when providers or vendors knowingly interfere with HIE[33]—reflects not only weak incentives, but perverse incentives. While not all providers and vendors experience perverse incentives, the combination of weak and perverse incentives suggests the need to strengthen incentives, so that both types of stakeholders are motivated to tackle the barriers to HIE development. Key to strengthening incentives are payers, who are thought to be the largest beneficiaries of HIE. Payers have been reluctant to make significant investments in HIE without a more active voice in its implementation,[34] but a shift to value-based payment may increase their engagement.

THE PATH FORWARD

Despite the continued challenges to nationwide HIE, several policy and technology developments show promise. Stage 3 meaningful use criteria continue to build on previous stages in increasing HIE requirements, raising the threshold for electronic exchange and EHR integration of summary of care documentation in patient transitions. The recently released Medicare Access and CHIP Reauthorization Act (MACRA) Merit-based Incentive Payment System (MIPS) proposed rule replaces stage 3 meaningful use for Medicare-eligible providers with advancing care information (ACI), which accounts for 25% of a provider's overall incentive reimbursement and includes multiple HIE criteria for providers to report as part of the base and performance score, and follows a very similar framework to stage 3 MU with its criteria regarding HIE.[35] While the Centers for Medicare and Medicaid Services (CMS) has not publicly declared that stage 3 MU will be replaced by ACI for hospitals and Medicaid providers, it is likely it will align those programs with the newly announced Medicare incentives.

MACRA also included changes to the Office of the National Coordinator (ONC) EHR certification program in an attempt to further encourage HIE. Vendors and providers must attest that they do not engage in information blocking

and will cooperate with the Office's surveillance programs to that effect. They also must attest that, to the greatest degree possible, their EHR systems allow for bi-directional interoperability with other providers, including those with different EHR vendors, and timely access for patients to view, download, and transmit their health data. In addition, there are emerging federal efforts to pursue a more standardized approach to patient matching and harmonize consent policies across states. These types of new policy initiatives indicate a continued interest in prioritizing HIE and interoperability.[21]

New technologies may also help spur HIE progress. The newest policy initiatives from CMS, including stage 3 MU and MACRA, have looked to incentivize the creation of application program interfaces (APIs), a set of publicly available tools from EHR vendors to allow developers to build applications that can directly interface with, and retrieve data from, their EHRs. While most patient access to electronic health data to date has been accomplished via patient portals, open APIs would enable developers to build an array of programs for consumers to view, download, and transmit their health data.

Even more promising is the development of the newest Health Level 7 data transmission standard, Fast Healthcare Interoperability Resources (FHIR), which promises to dramatically simplify the technical aspects of interoperability. FHIR utilizes a human-readable, easy to implement modular "resources" standard that may alleviate many technical challenges that come with implementation of an HIE system, enabling cheaper and simpler interoperability.[36] A consortium of EHR vendors are working together to test these standards.[28] The new FHIR standards also work in conjunction with APIs to allow easier development of consumer-facing applications[37] that may empower patients to take ownership of their health data.

CONCLUSION

While HIE holds great promise to reduce the cost and improve the quality of care, progress towards a nationally interoperable health system has been slow. Simply defining HIE and what types of HIE are needed in different clinical scenarios has proven challenging. The additional challenges to implementing HIE in complex technology, legal/regulatory, governance, and incentive environment are not without solutions. Continued policy interventions, private sector collaborations, and new technologies may hold the keys to realizing the vast potential of electronic HIE.

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Medicare and the 3-Inpatient Midnight Requirement: A Statute in Need of Modernization

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On July 30, 1965, Lyndon B. Johnson signed H.R. 6675 into law, establishing Medicare and Medicaid as Title XVIII and Title XIX of the Social Security Act.[1] Shortly after, Medicare's "extended care benefit" began, offering Medicare beneficiaries skilled nursing facility (SNF) care after a qualifying stay of 3 or more consecutive inpatient midnights.[2] Fifty years later, the word "inpatient" remains embedded in statute, limiting SNF coverage for Medicare beneficiaries hospitalized as outpatients under observation for part or all of a 3-midnight stay.[3]

At the individual Medicare beneficiary level, the financial impact of this policy is clear. The Office of Inspector General (OIG) reported a $10,503 beneficiary out-of-pocket cost per uncovered SNF stay following an observation hospitalization in 2012.[4] But the actual number of Medicare beneficiaries impacted by this coverage gap is unknown. Using 2009 claims data, Feng et al.[5] estimated that 0.75% of previously community dwelling Medicare beneficiaries are discharged to a SNF following an observation hospitalization, and the OIG reported 617,702 beneficiary hospital stays of 3 or more midnights not meeting the 3-midnight inpatient requirement in 2012, with 4% of these beneficiaries discharging to SNFs.[4] Yet these studies based on Medicare claims data only capture actual SNF utilization, failing to answer the critical question: How many Medicare beneficiaries need, but forgo, SNF care following a non-qualifying observation hospital stay? In this issue of the *Journal of Hospital Medicine*, Goldstein et al.[6] provide insight to that question. Using chart review of physical therapy and case management recommendations for post-acute SNF care, Goldstein et al.[6] compare actual discharge rate to SNF or acute inpatient rehabilitation following an observation stay when such disposition is recommended. In their two-hospital system, fewer than 20% of previously community-dwelling hospitalist patients followed recommendation for post-acute facility stay after observation hospitalization, and more than 40% cited financial concerns as the reason for declining. Patients recommended for SNF also were more likely to be rehospitalized in the subsequent 30 days after discharge, confirming this as a vulnerable patient population. Given Medicare's original intent to improve health care access for seniors, the case for change seems clear, and the repercussions of not addressing the plight of patients hospitalized under observation is having negative financial and overall detrimental health impacts.

But there are other compelling reasons why this 50-year-old law needs to be improved. Hospital care today is vastly different than when Medicare became law. Average hospital length of stay for patients 65 years and older was 14.2 days in 1965[7] compared to 5.2 days today,[8] clearly a shift in what 3 days of hospital care means. Most importantly, observation stays have become a major part of hospital care. Between 2006 and 2014, per-beneficiary outpatient visits (which include all observation stays) increased 44.2% nationally, while inpatient discharges decreased 19.9%.[9] In 2012, the Centers for Medicare & Medicaid Services (CMS) received 1.7 million outpatient observation claims and an additional 700,000 inpatient claims that started with observation days.[10] CMS also expected the 2-midnight rule to reduce outpatient observation stays,[4] but a recent OIG report[11] found that outpatient stays increased 8.1% in the first year (FY 2014) under the new rule, and there were still 748,337 long observation stays (those lasting 2 midnights or longer) in 2014, only a small (2.8%) decrease from the prior year. These factors limit Medicare beneficiary post–acute SNF eligibility in ways that could not have been anticipated when the extended care benefit was created to help seniors access needed health care.

Policymakers must consider cost when considering statutory change. Waiver programs in the 1980s suspending the 3-midnight requirement raised concerns over potential increase in both SNF utilization and associated costs.[12] However, more recent data suggest that altering the 3-midnight requirement may not increase post-acute SNF utilization. From 2006 to 2010, Medicare Advantage programs that waived the 3-midnight requirement saw a decrease in hospital length of stay without increased SNF utilization or SNF length of stay, indicating that access to the right level of care at the right time could be cost-saving.[13] Recent data from the Bundled Payments for Care Improvement (BPCI) program found savings were largely related to decreased SNF utilization when payments were episode-based,[14] a trend that may continue as Medicare moves away from fee-for-service towards bundled payments for more conditions.

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And although neither example directly tests changing the 3-midnight requirement to include observation midnights, both studies suggest that innovative health care delivery and modification of SNF access did not result in increased SNF utilization or greater post-acute costs. In fact, as Goldstein et al.[6] showed, patients recommended for post-acute SNF following observation stay were more likely to be rehospitalized within 30 days, an additional cost that could potentially be avoided if these patients had SNF access. We believe that these correlations strongly support rescinding the 3-midnight requirement, or at least amending it to allow nights spend under observation to count as "inpatient" for the purposes of SNF benefit coverage.

That being said, what can be done? In 2015, the Medicare Payment Advisory Commission (MedPAC) recommended changing the 3-night requirement to require just one of 3 midnights to be inpatient to make a qualifying stay.[10] Although an improvement over current law, this proposal would not help the majority of beneficiaries who are exclusively hospitalized under observation status. The "Improving Access to Medicare Coverage Act of 2015", to be reintroduced in Congress in the coming weeks, would count any midnight spent in the hospital towards the 3-midnight stay requirement, and has bipartisan, bicameral support and cosponsorship.[15] In 2015, through unanimous bipartisan, bicameral support, Congress passed the NOTICE Act (PL 114-42), which requires hospitals to inform Medicare beneficiaries hospitalized under observation.[16] We believe that the data are clear to both sides of the aisle that Congress should now work together using scientifically-supported research to improve the exact observation policies they felt patients should be informed of. Passing the Improving Access to Medicare Coverage Act is the logical next step in this arena.

Medicare was intended to give seniors access to the healthcare they need. Growth in hospital-based observation care begs for modernization of the statutory 3-inpatient midnight rule. Counting all midnights towards the 3-midnight requirement, whether those midnights are outpatient observation or inpatient, is the right first step.

Disclosures: Representative Courtney is the bill sponsor of the Improving Access to Medicare Coverage Act. The authors report no other conflicts.

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In Reference to "When Personality Is the Problem: Managing Patients With Difficult Personalities on the Acute Care Unit"

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In the article by Riddle et al,[1] the authors state that in the example of Cluster A type personality disorder, the elderly male patient's paranoid disorder should be ignored, rather than confronting the paranoia. We do not need to confront the paranoia, but we need to treat the paranoid disorder. The symptom of paranoia extends beyond the single diagnostic category of delusional disorder and has been noted in many elderly patients with other underlying disorders.[2] This patient needs early psychiatric consultation and therapy.

They also give recommendations regarding Ms. B for her ever-increasing need of opiates. I find it too naïve for me to offer this patient "…choices, such as walking with her around the unit or listen to the music." This patient needs pain physician consultations and aggressive interventional pain control.[3]

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The Authors Reply, "When Personality Is the Problem: Managing Patients With Difficult Personalities on the Acute Care Unit"

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Thank you for the opportunity to reply to Dr. Hunasikatti's comments regarding our article.[1] He brings up some excellent points and we appreciate the opportunity to clarify.

With regards to our example of Cluster A personality, the elderly individual with paranoia, we agree that the differential must include delirium and dementia and an appropriate work-up completed. The intent of the vignette was to illustrate a functional but eccentric individual with paranoid beliefs. The paranoia associated with paranoid personality disorder is classically not responsive to medications—nor are patients typically amenable to such treatment—and behavioral interventions remain paramount, minimizing the negative impact of paranoia on the individual's care.[2,3]

Regarding Ms. B, the vignette stated that the pain service was consulted, as Dr. Hunasikatti suggested it should be, but despite aggressive pain control, requests for opiates continued. We agree that appropriate pain management is critical in management of all patients, and pain can exacerbate behavioral issues when insufficiently treated. However, individuals who look to external sources of comfort may continue to request pain medications beyond what is clinically prudent and can benefit from learning additional skills to self-soothe and manage the psychological aspects of pain.[4,5]

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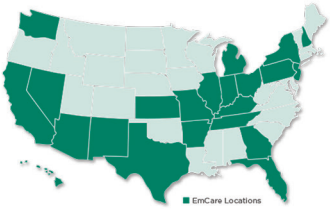

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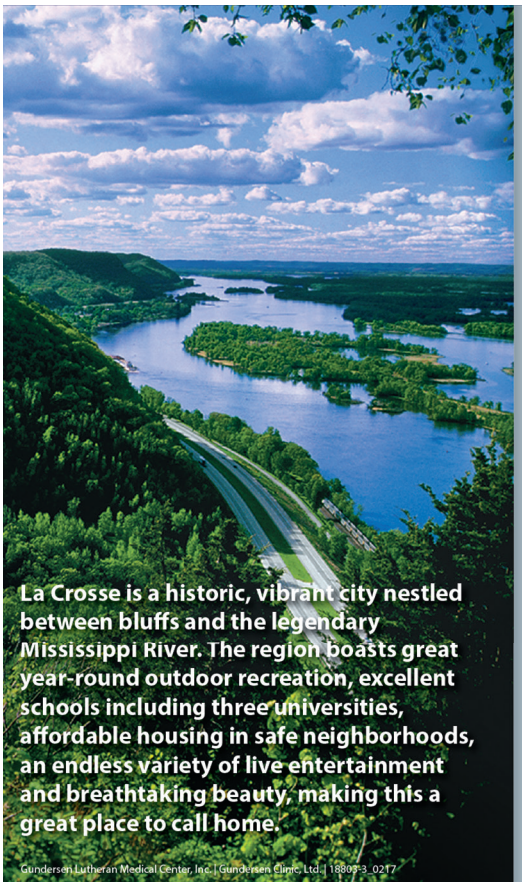

La Crosse is a historic, vibrant city nestled between bluffs and the legendary Mississippi River. The region boasts great year-round outdoor recreation, excellent schools including three universities, affordable housing in safe neighborhoods, an endless variety of live entertainment and breathtaking beauty, making this a great place to call home.

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Hospitalist - Maine

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Interested candidates should contact Julia Lauver, CMMC Physician Recruitment, 300 Main Street, Lewiston, ME 04240; email LauverJu@cmhc.org; call 800/445/7431; fax 207/755-5854.

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