

HEALTH CARE REFORM

Structured Interdisciplinary Rounds in a Medical Teaching Unit

Improving Patient Safety

Kevin J. O'Leary, MD, MS; Ryan Buck, MD; Helene M. Fligel, MD; Corinne Haviley, RN, MS; Maureen E. Slade, MS, RN, CS; Matthew P. Landler, MD; Nita Kulkarni, MD; Keiki Hinami, MD, MS; Jungwha Lee, PhD, MPH; Samuel E. Cohen, MD; Mark V. Williams, MD; Diane B. Wayne, MD

Background: Effective collaboration and teamwork is essential to providing safe hospital care. The objective of this study was to assess the effect of an intervention designed to improve interdisciplinary collaboration and lower the rate of adverse events (AEs).

Methods: The study was a controlled trial of an intervention, Structured Inter-Disciplinary Rounds, implemented in 1 of 2 similar medical teaching units in a tertiary care academic hospital. The intervention combined a structured format for communication with a forum for regular interdisciplinary meetings. We conducted a retrospective medical record review evaluating 370 randomly selected patients admitted to the intervention and control units (n=185 each) in the 24 weeks after and 185 admitted to the intervention unit in the 24 weeks before the implementation of Structured Inter-Disciplinary Rounds (N=555). Medical records were screened for AEs. Two hospitalists confirmed the presence of AEs and assessed their preventability and severity in a masked fashion. We used multivariable Poisson regression models to compare the

adjusted incidence of AEs in the intervention unit to that in concurrent and historic control units.

Results: The rate of AEs was 3.9 per 100 patient-days for the intervention unit compared with 7.2 and 7.7 per 100 patient-days, respectively, for the concurrent and historic control units (adjusted rate ratio, 0.54; $P=.005$; and 0.51; $P=.001$). The rate of preventable AEs was 0.9 per 100 patient-days for the intervention unit compared with 2.8 and 2.1 per 100 patient-days for the concurrent and historic control units (adjusted rate ratio, 0.27; $P=.002$; and 0.37; $P=.02$). The low number of AEs rated as serious or life-threatening precluded statistical analysis for differences in rates of events classified as serious or serious and preventable.

Conclusion: Structured Inter-Disciplinary Rounds significantly reduced the adjusted rate of AEs in a medical teaching unit.

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Author Affiliations: Division of Hospital Medicine (Drs O'Leary, Landler, Kulkarni, Hinami, Cohen, and Williams) and Departments of Medicine (Drs Buck, Fligel, and Wayne) and Preventive Medicine (Dr Lee), Northwestern University Feinberg School of Medicine, and Department of Medicine Nursing, Northwestern Memorial Hospital (Mss Haviley and Slade), Chicago, Illinois. Ms Haviley is now with the Department of Nursing, Central DuPage Hospital, Winfield, Illinois. Dr Cohen is now a resident in the Department of Medicine, Einstein Montefiore Medical Center, New York, New York.

IN ITS SEMINAL REPORT, *CROSSING the Quality Chasm: A New Health System for the Twenty-first Century*, the Institute of Medicine characterized the current provision of health care as "more to know, more to manage, more to watch, more to do, and more people involved in doing it than at any time in the nation's history."^{1(p.25)} The description by the Institute of Medicine is particularly applicable to the acute care hospital setting, in which many patients experience adverse events (AEs).^{2,3} Although many AEs are not preventable, a large portion of those that are preventable are attributed to communication failures.⁴⁻⁶

See Invited Commentary at end of article

Communication practices⁷⁻⁹ and interventions designed to improve teamwork

have been studied in many clinical settings.¹⁰⁻¹⁴ However, little research has focused on improving teamwork at the most common site of hospital care—medical-surgical units. Several important and unique barriers to effective communication among health care professionals exist in these units: teams are large and formed in an ad hoc fashion and team membership is dynamic and dispersed. Physicians, nurses, pharmacists, and other team members typically care for multiple patients simultaneously and work in shifts or rotations, resulting in team membership variability (few patients have identical team membership) and instability (each team has members joining and departing). Research has shown that nurses and physicians in patient care units do not communicate consistently and they frequently are not in agreement regarding their patients' plans of care.^{15,16} Further-

more, although physicians give high ratings to the quality of their collaboration with nurses, nurses consistently rate the quality of collaboration with hospital physicians relatively poorly.^{8,9,17}

Interdisciplinary rounds (also known as multidisciplinary rounds) have been used as a means to assemble team members in patient care units and improve collaboration regarding the plan of care.¹⁸⁻²⁰ Two recent articles reported on the use of Structured Inter-Disciplinary Rounds (SIDR), an intervention that combines a structured format for communication and a forum for daily interdisciplinary meetings.^{21,22} The intervention was well received by health care professionals and resulted in improved ratings of collaboration and teamwork from nurses. The goal of this study was to assess the effect of the intervention on the rate of AEs in a medical teaching unit.

METHODS

SETTING AND STUDY DESIGN

The study was conducted at Northwestern Memorial Hospital, an 897-bed tertiary care teaching hospital in Chicago, Illinois, and was approved by the Institutional Review Board of Northwestern University. The study was a controlled trial of an intervention, SIDR, regarding the rate of AEs in general medicine patient care units. One of 2 similar teaching service units was randomly selected for the intervention and the other served as a concurrent control unit. General medical patients were admitted to the study units by Northwestern Memorial Hospital bed assignment personnel in a quasirandomized fashion subject to unit bed availability. No other criteria (eg, diagnosis, severity of illness, or source of patient admission) were used in patient assignment.

Each medical teaching unit consisted of 30 beds and was equipped with continuous cardiac telemetry monitoring. Each unit was staffed by teaching-service physician teams consisting of 1 attending, 1 resident, 1 to 2 interns, and 1 to 2 third-year medical students. Attending physicians rotated into the study units in 2-week blocks and house staff rotated in 4-week blocks. The schedule and makeup of physician teams was created by the chief medical resident with no effort made to place certain physicians in specific study units. As a result of a prior intervention, teaching-service physician teams were localized to specific units in an effort to improve communication practices among nurses and physicians.²³ Both units had physician localization and similar structure and staffing of nonphysician health care professionals. Unidirectional alphanumeric paging was available to physicians and nurses on both study units, and all professionals used a fully integrated electronic medical record and computerized physician order entry system (PowerChart Millennium; Cerner Corporation, North Kansas City, Missouri).

INTERVENTION

Structured Inter-Disciplinary Rounds combined a structured format for communication and a forum for regular interdisciplinary meetings. A working group consisting of nurses, resident physicians, pharmacists, and the unit social worker and case manager met every other week during the 3 months before implementation to determine the optimal timing, frequency, format, and location for SIDR. Also, the working group finalized the content of a structured communication tool used during SIDR for newly admitted patients (eAppendix; <http://www.archinternmed.com>). This tool was modeled after prior research demonstrating the benefit of daily goals-of-care forms^{11,13} and ensured that

important elements of the plan of care were discussed. Based on the working group's recommendation, SIDR took place each weekday at 11 AM in the unit nursing report room and lasted 30 to 40 minutes. The nurse manager and a unit medical director jointly led rounds each day and facilitated closed-loop communication among team members. Structured Inter-Disciplinary Rounds was attended by all nurses and resident physicians caring for patients in the unit, as well as the pharmacist, social worker, and case manager assigned to the unit. The structured communication tool was used in SIDR for all patients newly admitted (ie, in the previous 24 hours) to the unit. The daily plan of care for all other patients was also discussed in SIDR but without the aid of the structured communication tool. This decision was made by the working group in an effort to balance effective communication among professionals with work efficiency. The SIDR program was implemented on July 28, 2008.

AE REVIEW

We conducted a medical record abstraction of 370 randomly selected patients admitted to the intervention and control teaching service units (185 each) from July 28, 2008, through January 11, 2009. In addition, we abstracted medical records for 185 randomly selected patients hospitalized in the intervention unit from January 8, 2008, through June 22, 2008, a period that occurred after localization of physicians to specific patient care units but before the start of the new intern class and the implementation of SIDR. Two internal medicine physicians (R.B. and H.M.F.) identified potential AEs using screening criteria adapted from prior research (eTable 1)^{3,24,25} and created a narrative summary for each potential AE identified. The physicians performing medical record abstractions received specific training for this study, including an overview of the study, definitions of terms, practice with data collection tools, and discussion of examples of AEs. We defined an AE as an injury due to medical management rather than the natural history of the illness.

Narrative summaries of potential AEs were reviewed in a masked fashion by 2 internal medicine physician-researchers (M.P.L. and N.K.) to determine the presence and preventability of AEs. Physician reviewers used a 6-point confidence scale similar to that used in prior research studies^{3,25-27} to rate the presence of AEs: 1 indicated no evidence that outcome was due to treatment; 2, little evidence that outcome was due to treatment; 3, outcome was possibly due to treatment but was more likely due to disease; 4, outcome was more likely due to treatment than to disease; 5, outcome was probably due to treatment; and 6, outcome was definitely due to treatment. We used a similar 6-point confidence scale to assess the preventability of AEs: 1 indicated virtually no evidence of preventability; 2, slight to modest evidence of preventability; 3, preventability not quite likely; 4, preventability more likely than not; 5, strong evidence of preventability; and 6, virtually certain evidence of preventability.^{3,25-27} We required a confidence score of 4 or greater for determination of the presence and preventability of an AE. Physician reviewers also classified AEs according to 4 levels of severity (life threatening, serious, clinically significant, or trivial).²⁸ An example of a life-threatening event is a nosocomial urinary tract infection that leads to septic shock. Serious events include those that lead to interventions or prolonged hospitalizations (for example, a pressure ulcer or a wound infection that requires debridement). Clinically significant events are more transient (for example, an adverse drug event causing transient abnormalities in laboratory test results). Trivial or insignificant events include minor injuries, such as pain at a venipuncture site. Finally, AEs were assigned to 1 of 10 prespecified categories. Both physician reviewers were experienced in medical record review methods to identify AEs and also received specific training for

Table 1. Characteristics of Patients^a

Characteristic	No. (%)			P Value	
	Control Unit (n=185)	Intervention Unit Pre-SIDR (n=185)	Intervention Unit Post-SIDR (n=185)	Control vs Intervention Unit Post-SIDR	Intervention Unit Pre-SIDR vs Post-SIDR
Age, mean (SD), y	58.0 (19.1)	59.4 (19.1)	59.5 (19.2)	.43	.96
Women	104 (56.2)	101 (54.6)	100 (54.1)	.68	.92
Race other than white	81 (43.8)	100 (54.1)	89 (48.1)	.40	.25
Night admission	82 (44.3)	71 (38.4)	87 (47.0)	.60	.09
Weekend or holiday admission	54 (29)	60 (32.4)	58 (31.4)	.65	.82
Critical care unit admission	17 (9.2)	21 (11.4)	22 (11.9)	.40	.87
Contact isolation	27 (14.6)	30 (16.2)	26 (14.1)	.88	.56
Payer					
Medicare	87 (47.0)	95 (51.4)	94 (50.8)	.87	.41
Private	56 (30.3)	56 (30.3)	53 (28.6)		
Medicaid	25 (13.5)	25 (13.5)	25 (13.5)		
Self	17 (9.2)	9 (4.9)	17 (9.2)		
Admission source					
Emergency department	158 (85.4)	164 (88.6)	157 (84.9)	.90	.02
Direct	22 (11.9)	11 (5.9)	24 (13.0)		
Transfer	5 (2.7)	10 (5.4)	4 (2.2)		
Case mix					
Nonspecific chest pain	12 (6.5)	15 (8.1)	7 (3.8)	.24	.08
Pneumonia	5 (2.7)	10 (5.4)	10 (5.4)	.19	>.99
Chronic obstructive pulmonary disease	6 (3.2)	6 (3.2)	12 (6.5)	.15	.15
Skin and subcutaneous tissue infection	6 (3.2)	3 (1.6)	8 (4.3)	.59	.13
Acute renal failure	1 (0.5)	5 (2.7)	9 (4.9)	.01	.28
Septicemia	3 (1.6)	6 (3.2)	6 (3.2)	.31	>.99
Diabetes mellitus with complications	4 (2.2)	7 (3.8)	4 (2.2)	>.99	.36
Asthma	5 (2.7)	5 (2.7)	4 (2.2)	.74	.74
Other lower respiratory tract disease	3 (1.6)	8 (4.3)	3 (1.6)	>.99	.13
Congestive heart failure	7 (3.8)	2 (1.1)	4 (2.2)	.36	.41
Fluid and electrolyte disorder	1 (0.5)	7 (3.8)	5 (2.7)	.10	.56
Hypertension with complications	5 (2.7)	3 (1.6)	5 (2.7)	>.99	.48
Other diagnosis	127 (68.6)	108 (58.4)	108 (58.4)	.04	>.99
Charlson comorbidity index score, mean (SD)	1.5 (1.9)	1.8 (2.1)	1.8 (2.2)	.17	.68
Length of stay, mean (SD), d	4.9 (5.7)	5.3 (5.7)	4.8 (5.0)	.78	.32
Days on study unit, mean (SD)	4.8 (3.9)	4.8 (5.0)	4.8 (4.1)	.83	.96
Diagnosis related group weight, mean (SD)	1.4 (2.1)	1.2 (0.8)	1.2 (0.6)	.21	.55

Abbreviations: ellipses, not applicable; SIDR, Structured Inter-Disciplinary Rounds.

^aPercentages may not total 100 because of rounding. Analyses performed using *t* and χ^2 tests.

this study, including definitions of terms, practice with data collection tools, and discussion of examples of AEs. After independent review, the physician reviewers discussed any areas of disagreement and developed consensus ratings.

We assessed the performance of the initial stage of our medical record review method by conducting duplicate abstractions and consensus ratings for the presence and preventability of AEs for a randomly selected sample of 28 patients. The interrater reliability for identification of potential AEs was good ($\kappa=0.73$). The interrater reliability was excellent for the presence ($\kappa=0.78$) and preventability ($\kappa=1$) of AEs.

DATA ANALYSIS

Patient data were obtained from administrative databases and complemented the information from the medical record review. Demographic characteristics were compared using χ^2 and *t* tests for categorical and continuous data, respectively. Primary discharge diagnosis *International Classification of Diseases-9* codes were grouped into diagnosis clusters using the Clinical Classification Software developed by the Healthcare Cost and Utilization Project (<http://www.hcup-us.ahrq.gov/toolsoftware/ccs/ccs/jsp>). Diagnosis clusters were then analyzed using χ^2 tests. We analyzed consensus ratings of AEs using

several methods. We used χ^2 tests to compare the percentage of patients with 1 or more AE between the concurrent and historic control units. We also performed multivariable Poisson regression analyses to compare the rate of total and preventable AEs using the concurrent and historic control unit data. All models included patient age, sex, and race as covariates and the number of days in the study unit as the exposure variable. We used backward selection techniques for additional variables, including night admission, weekend and holiday admission, contact isolation status, payer, source of admission, case mix, Charlson comorbidity index (medical record-based),²⁹ and diagnosis related group weight (Medicare, 2008 version). Variables were retained in models at a *P* value of less than .1. Because some patients were initially admitted to the intensive care unit before transfer to the study units and owing to a concern that errors contributing to AEs may have occurred before transfer, we repeated analyses restricted to patients initially admitted to the study units. The results were similar and therefore are not reported. We also evaluated the effect of clustering of physicians on study units by repeating models with standard errors robust to the clustering of patients within the data for each physician. We used separate models for the attending, resident, and intern physicians and for the team as a whole. Finally, we repeated analyses using attending physician status (hos-

Table 2. Effect of SIDR on Adverse Events (AEs) in a Medical Teaching Service^a

AEs, No. (No. per 100 patient-days)	Control Unit (n=185)	Intervention Unit Pre-SIDR (n=185)	Intervention Unit Post-SIDR (n=185)	Control vs Intervention Unit Post-SIDR		Intervention Unit Pre-SIDR vs Post-SIDR	
				Incidence Rate Ratio (95% CI)	P Value	Incidence Rate Ratio (95% CI)	P Value
Any	63 (7.2)	69 (7.7)	35 (3.9)	0.54 (0.36-0.83)	.005	0.51 (0.33-0.76)	.001
Preventable	25 (2.8)	19 (2.1)	8 (0.9)	0.27 (0.12-0.62)	.002	0.37 (0.15-0.82)	.02
Serious	6 (0.7)	15 (1.7)	8 (0.9)	NA	NA	NA	NA
Serious and preventable	2 (0.2)	2 (0.2)	0 (0)	NA	NA	NA	NA

Abbreviations: CI, confidence interval; NA, not available because of low number of events; SIDR, Structured Inter-Disciplinary Rounds.

^aSerious events include those rated serious or life threatening.

pitalist vs nonhospitalist) as a covariate. Results for these models accounting for differences in physician team makeup were similar and therefore not reported. All analyses were conducted using Stata version 10.1 (StataCorp LP, College Station, Texas).

RESULTS

CHARACTERISTICS OF PATIENTS

With few exceptions, intervention unit patients were similar to those in the concurrent and the historic control units (**Table 1**). More patients with acute renal failure and fewer patients with “other” diagnoses were admitted to the intervention unit compared with the concurrent control unit. More patients in the intervention unit were directly admitted and fewer were transferred from outside hospitals during the post-SIDR compared with the pre-SIDR period.

RATINGS OF AEs

Overall, 30 patients in the intervention unit (16.2%), 46 in the concurrent control unit (24.9%), and 49 historic control patients (26.5%) experienced 1 or more AEs ($P=.04$ and $.02$ for comparison of intervention unit with concurrent and historic control units, respectively). Patients in the intervention unit experienced a significantly lower adjusted rate of total and preventable AEs compared with the concurrent and the historic controls (**Table 2**). Specifically, the rate of AEs was 3.9 per 100 patient-days in the intervention unit compared with 7.2 per 100 patient-days in the control unit and 7.7 per 100 patient-days during the historic control period (incidence rate ratio [IRR], 0.54; $P=.005$; and 0.51; $P=.001$, respectively). The rate of preventable AEs was 0.9 per 100 patient-days in the intervention unit compared with 2.8 per 100 patient-days in the control unit and 2.1 per 100 patient-days during the historic control period (IRR, 0.27; $P=.002$; and 0.37; $P=.02$, respectively). Selected examples of preventable AEs are summarized in **Table 3**. The low number of AEs rated as serious or life threatening precluded statistical analysis for differences in rates of events classified as serious or preventable.

Categories of AEs are shown in **Table 4**. Adverse drug events accounted for the largest portion of AEs, followed by manifestation of poor glycemic control. The rate of adverse drug events was 1.6 per 100 patient-days in the intervention unit compared with 3.8 per 100 patient-

days in the control unit and 3.5 per 100 patient-days during the historic control period (IRR, 0.42; $P=.006$; and 0.47; $P=.02$, respectively). The rate of AEs not categorized as drug related was 2.3 per 100 patient-days in the intervention unit compared with 3.4 per 100 patient-days in the control unit and 4.3 per 100 patient-days during the historic control period (IRR, 0.69; $P=.22$; and 0.53; $P=.02$, respectively). The low number of non-drug-related AEs in each category precluded statistical analysis for specific differences in rates between the intervention and the concurrent units or the historic control period.

COMMENT

We found that patients hospitalized in a medical teaching unit using SIDR experienced a significantly lower rate of AEs compared with concurrent or historic controls. The effect was mainly explained by a reduction in the rate of AEs deemed to be preventable. We found a low number of AEs rated as serious or life-threatening, which precluded statistical analysis for differences in rates of events classified as serious or serious and preventable. Similar to the findings from prior research evaluating hospital AEs in medical patients,^{3,27} we found that adverse drug events were the leading cause of AEs, accounting for nearly as many events as all other categories combined.

Lemieux-Charles and McGuire³⁰ and Salas et al³¹ have noted that team size, instability, and geographic dispersion of membership serve as significant barriers to teamwork. Geographic localization of physicians, which had been previously implemented by some members of our research team,²³ provided a foundation for the current intervention. Structured Inter-Disciplinary Rounds provided a means for facilitated, interdisciplinary discussion regarding the plan of care. Our intervention incorporated valuable lessons from prior research, including the role of leadership in shaping team culture and norms³⁰ and the need for input from frontline professionals in the design of interdisciplinary rounds.^{18,20} The intervention also included the use of a structured communication tool intended to prompt discussion regarding essential elements and to create a shared understanding regarding the plan of care. Similar tools, such as daily goals-of-care forms and surgical safety checklists, have been shown to improve team members' understanding of the plan of care^{11,13} and to improve patient outcomes.¹⁴ The current study

Table 3. Examples of Preventable Adverse Events

Description of Adverse Event	Severity	Category	Study Unit
The patient, who had recently undergone large-volume liposuction for morbid obesity, was admitted for postoperative hemorrhage. She was continued on her outpatient medications, including a tricyclic antidepressant, and treated with oral analgesics. She developed constipation on hospital day 4, requiring multiple cathartics.	Clinically significant	Adverse drug event	Intervention unit pre-SIDR
The patient, who had recently undergone a nephrectomy for renal cell carcinoma, was admitted for flank pain and fevers of uncertain cause. Pharmacologic prophylaxis for venous thromboembolism was not started on admission. The patient developed tachycardia and hypotension on hospital day 3, and a subsequent ventilation-perfusion lung scan showed high probability for pulmonary embolus.	Serious	Venous thromboembolism	Control unit
The patient was admitted for alcohol withdrawal and became increasingly agitated and fell on hospital day 2 but sustained no injury related to the fall.	Clinically significant	Fall	Intervention unit post-SIDR
The patient was admitted with exacerbation of heart failure. At the time of admission, she had an indwelling urinary catheter placed. On hospital day 4, she developed fever, and urinalysis and culture results were consistent with urinary tract infection.	Clinically significant	Hospital-acquired infection	Control unit
The patient, who had a history of atrial fibrillation and prior pulmonary embolus, was admitted with community-acquired pneumonia and treated for heart failure exacerbation. The international normalized ratio rose to 5.1 with antibiotic treatment, although no evidence of hemorrhage was found.	Clinically significant	Adverse drug event	Control unit
The patient was admitted with exacerbation of underlying chronic obstructive pulmonary disease and was treated with corticosteroids. The glucose level rose to >400 mg/dL on hospital day 2 and remained elevated through hospital day 4.	Clinically significant	Poor glycemic control	Intervention unit pre-SIDR
The patient, who had a history of peripheral arterial disease and diabetes mellitus, was admitted with fever. He had been taking half his prescribed long-acting daily insulin dosage before admission. On admission, he was prescribed the full dosage and had a glucose level of 48 mg/dL on hospital day 3.	Clinically significant	Poor glycemic control	Intervention unit pre-SIDR
The patient, who had a history of multiple myeloma and prostate cancer, was admitted with urinary tract infection. A 3-cm stage I sacral pressure ulcer was discovered on hospital day 4.	Clinically significant	Pressure ulcer	Intervention unit post-SIDR

Abbreviation: SIDR, Structured Inter-Disciplinary Rounds.
SI conversion factor: To convert glucose to millimoles per liter, multiply by 0.0555.

Table 4. Effect of SIDR on Adverse Events, by Category

Category of Adverse Events	Control Unit, No. (n=63)	Intervention Unit, No.	
		Pre-SIDR (n=69)	Post-SIDR (n=35)
Adverse drug event ^a	33	31	14
Adverse event not drug related	30	38	21
Manifestation of poor glycemic control	9	15	4
Hospital-acquired infection	5	2	3
Operative/procedural injury	2	5	2
Pressure ulcer	5	2	1
Delirium	1	2	3
Fall	1	3	2
Venous thromboembolism	2	1	0
Acute renal failure	0	1	0
Other	5	7	6

Abbreviation: SIDR, Structured Inter-Disciplinary Rounds.
^aAdjusted incidence rate ratios for adverse drug events compared with control and intervention units pre-SIDR were 0.42; $P=.006$; and 0.47; $P=.02$, respectively. Adjusted incidence rate ratios for adverse events not categorized as drug related compared with control and intervention units pre-SIDR were 0.69; $P=.22$; and 0.53; $P=.02$, respectively.

builds on prior research²² that found that SIDR was well received by hospital professionals and significantly improved nurses' ratings of collaboration and teamwork. Notably, prior analysis found no effect on length and cost of stay but may have been underpowered in this regard.²²

Adverse drug events were the most common category of AE in our study and were significantly reduced by the

intervention. The reduction in adverse drug events is notable, given the use of a fully integrated electronic medical record and computerized physician order entry system in the study units. Our findings support the benefit of including nurses and clinical pharmacists in medication discussions and are in agreement with prior research³² showing a reduction in the rate of adverse drug events resulting from greater interaction between clinical pharmacists and patients' health care teams. Manifestations of poor glycemic control were the second most common category of AE in our study. Although the number of AEs in this category was lower in the intervention unit, the low number precluded statistical analysis. We hypothesize that extreme derangements in glycemic control may have been averted in the intervention unit because of enhanced communication between nurses and physicians regarding changes in diet, insulin management, and glucose testing.

Our findings are important because poor communication represents a major cause of preventable AEs in hospitals.^{5,6,25,33,34} Higher ratings of collaboration and teamwork have been associated with more favorable patient outcomes in observational studies.³⁵⁻³⁷ Recently, Kim and colleagues³⁸ reported an association between the use of interdisciplinary rounds and lower mortality among intensive care unit patients. To our knowledge, ours is the first study to report the effect of interdisciplinary rounds on patient safety-related outcomes in a non-intensive care unit setting.

Structured Inter-Disciplinary Rounds appears to be an effective strategy to promote values and practices con-

sistent with teamwork found in high-reliability organizations.^{39,40} Teams in such organizations are characterized by their ability to work consistently and effectively over time in complex, dynamic environments while enduring high levels of stress.⁴¹ On a practical level, SIDR establishes a forum for the exchange of critical clinical information, collaboration regarding the plan of care, and opportunities to detect and correct errors. These collaborative interactions allow for closed-loop communication, performance monitoring, collective orientation, planning, and team self-correction, among techniques found to enhance team performance.³⁹⁻⁴¹

Our study has several limitations. First, it reflects the experience of an intervention in a teaching service unit in a single hospital. We used a concurrent and a historic control in an effort to minimize the effect of potential confounders. Our results were consistent in each comparison, but larger studies will be required to test the reproducibility and generalizability of our findings. Second, our evaluation of AEs was limited to the information available from the medical record. Direct observation and/or interview of health care professionals may have provided important additional information regarding errors and AEs. Third, because the electronic medical record used during medical record abstraction included information regarding dates and hospital unit assignment, we were unable to mask medical record abstractors with regard to patient unit or study time period. Physician reviewers of potential AEs were masked to unit and time of care. The lack of masking at the medical record abstraction stage may bias our study toward finding a positive effect of the intervention. We assessed the performance of the initial stage of our medical record review method by conducting duplicate abstractions and ratings for a random sample of patients and found good interrater reliability for screening of potential AEs and excellent interrater reliability for the presence and preventability of AEs. Fourth, patients were not formally randomized to study units, resulting in small differences in patient characteristics between units. We conducted multivariable regression analyses in an effort to control for confounding due to differences in patient characteristics. Finally, the low number of serious AEs in our study precluded our ability to detect a difference in serious or serious and preventable AEs as a result of the intervention.

In summary, SIDR resulted in a lower rate of AEs in a medical teaching unit. Future efforts should assess the effect of SIDR on AEs of serious clinical severity and whether the intervention reduces the rate of AEs when implemented on a broader scale.

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Correspondence: Kevin J. O'Leary, MD, MS, Division of Hospital Medicine, Northwestern University Feinberg School of Medicine, 211 E Ontario St, Seventh Floor, Chicago, IL 60611 (keoleary@nmh.org).

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Online-Only Material: The eAppendix and eTable are available at <http://www.archinternmed.com>.

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INVITED COMMENTARY

Communication Failures and a Call for New Systems to Promote Patient Safety

Communication and teamwork failures are well-known threats to patient safety and form the basis of most root causes in reported sentinel events.¹ Strategies to improve communication have largely focused on implementing formal teamwork training programs, teaching specific communication skills, and adopting tools that promote communication and more favorable team behavior. Unfortunately, these interventions have produced mixed results, in part because of challenges in collecting and analyzing clinical outcomes affected by teamwork changes.^{2,3}

The underlying rationale for improving communication and teamwork in health care is to remove professional silos. Often, attempted interventions use shared communication tools and lexicons to help bridge existing gaps in training, experience, and teamwork between different health care professionals and disciplines. For example, SBAR (Situation, Background, Assessment, and Recommendation) is a commonly taught communication strategy in

which health care professionals deliver critical clinical information in a structured format.⁴ Similarly, procedural settings are required to practice a *time-out*—an active and structured communication used among members of a surgical/procedural team to ensure common understanding of the procedure and as an opportunity to clarify questions or concerns. Operative debriefings, formalized checklists, and daily goals of care are additional interventions designed to foster improved communication. An important common element to these strategies is that they focus on a specific point in care (eg, immediately before induction of anesthesia) or a specific clinical event (eg, the acute deterioration of the health of a patient).

However, most clinical communication and teamwork does not happen in the context of specific events. In fact, rapidly changing clinical states and care plans are common in the hospital setting, placing patients at consistent risk for AEs. A key strategy in improving teamwork in this broader context is the interdisciplinary team