Hospital Patient Safety: Characteristics of Best-Performing Hospitals

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EXECUTIVE SUMMARY

Hospitals have made slow progress in meeting the Institute of Medicine's patient safety goals, and implementation of safety systems has been inconsistent. The next logical question is this: What organizational characteristics predict greater implementation of patient safety systems, in terms of both extent of systems and progress over time?

To answer this question, a survey was administered to 107 hospitals at two points in time. Data were consolidated into seven latent variables measuring progress in specific areas. Using the overall measure, Joint Commission–accredited hospitals showed statistically significant improvement, as reflected in the sum score ($p = .01$); nonaccredited hospitals did not show statistically significant improvement ($p = .21$). Joint Commission accreditation was the key predictor of patient safety system implementation. Management type and urban/rural status were secondary predictors.

Several factors may account for the strong association between accreditation and patient safety system implementation. In 2003, the Joint Commission began tying accreditation to patient safety goals. Also, Joint Commission data are now widely available to the public and may stimulate hospitals to address safety issues. Healthcare executives, hospital trustees, regulators, and policymakers should encourage Joint Commission accreditation and reward hospital efforts toward meeting Joint Commission standards. The Joint Commission should continually strive to maintain evidence-based and state-of-the-art standards that advance the aim of providing the best possible care for hospitalized patients.

For more information on the concepts of this article, please contact Dr. Longo at drlongo@vcu.edu.

Seven years ago, the Institute of Medicine (IOM) reported that at least 44,000, and perhaps as many as 98,000, deaths annually could be attributed to medical errors and that such preventable adverse events cost the United States an estimated $17 billion to $29 billion (Chassin and Galvin 1998; Kohn, Corrigan, and Donaldson 2000). The IOM not only urged hospitals and healthcare professionals to improve patient safety practices, but it also called on Congress and other policymakers, regulators, private and public purchasers, and patients to work together toward redesigning a national health system that is safe, effective, patient centered, timely, efficient, and equitable (Committee on Quality Health Care in America 2001). Yet concerns about patient safety continue to be raised. Senators Hillary Rodham Clinton (D-NY) and Barack Obama (D-IL) recently added their voices to others, calling for improvements in patient safety, along with open disclosure when errors occur, as a "centerpiece" in addressing the nation's medical liability crisis (Clinton and Obama 2006; Hattie and Sheridan 2003; Rao et al. 2006). Critics have cited IOM findings that more than 90 percent of deaths from medical errors are the result of failed systems and procedures, rather than physician negligence (Kohn, Corrigan, and Donaldson 2000), as well as the conclusions of other studies and commentaries indicating that medical malpractice lawsuits more often stem from ineffective communication between patients and providers than from adverse medical outcomes in themselves (Sage 2003; Vincent, Young, and Phillips 1994). Although different databases and methods were used, other researchers have reached similar conclusions (AHRQ 2004; AHRQ 2005; Altman, Clancy, and Blendon 2004; Galvin et al. 2005; Leape and Berwick 2005; Wachter 2004). According to Longo and colleagues (2005), "The current status of hospital patient safety systems is not close to meeting IOM recommendations.... System progress is slow and is a cause for great concern" (2858). Others have pointed out the need for a comprehensive systems approach to patient safety and the challenge of identifying appropriate measurement methods (Stryer 2004; Thomas and Petersen 2003). Yet, as Longo and colleagues (2005) point out, patient safety systems are not being developed consistently. In this study, we examined characteristics of those hospitals that are (1) likely to have more extensive patient safety systems than others and (2) likely to have made more progress in implementing such programs over time.

METHODS

We used a two-factor (states—Utah and Missouri; survey time) quasi-experimental design with repeated measures on one factor (surveys were conducted twice, approximately 18 months apart). Data were obtained from a 91-question survey using dichotomous (yes/no) and seven-level ordinal measurement questions. For this study we used data from the cohort of hospitals that responded to the survey at both points in time

(n = 107, response rate = 65.2 percent). In a previous study (Longo et al. 2005), given the large number of variables, seven latent variables were constructed from the ordinal-level questions to summarize data and identify key aspects of patient safety (Table 1). We developed a measure of the overall level of system implementation that permits us to address a fundamental question previously unanswered: What organizational characteristics are associated with better performance in implementing patient safety systems? The concept of systems and their applicability to patient safety, as well as the generalizability of findings, were discussed in a previous article (Longo et al. 2005). We developed a latent variable summary measure that was consistent with established methods (Fox 1970; Johnson and Wichern 1992) and resulted in a coefficient α of 0.85. We correlated the sum with each of the seven-level questions. All correlations were positive, and all but one were highly significant; 47 of them had p values <.0001 (Table 2). These tests support the summary measure as an excellent method to capture system implementation.

Hospitals completing both surveys (n = 107) were included in our analyses. We considered bed size as both a quantitative and a dichotomous variable to make the best possible use of all bed-size information. A plot of the latent variable sum against bed size (Figure 1) was used to group hospitals by size; bed size of 0–99 was in one group and bed size ≥100 was in the other. Other organizational characteristics of interest included management type, rural or urban location, and Joint Commission accreditation status. These were the type of variables considered in previous empirical investigations of the relationship of hospital organizational structure to various outcomes (Ayanian and Weissman 2002; Flood and Scott 1987; Griffith, Knutzen, and Alexander 2002; Kovner and Neuhauser 1990; Scott 1990; Shortell, Morrison, and Robbins 1990; Sloan et al. 2003; Thomas, Orav, and Brennan 2000). We examined means, medians, and standard deviations for quantitative variables and frequencies for categoric variables. The Wilcoxon rank sum test or Kruskal-Wallis test was used to determine if quantitative variables differed across categories. The Wilcoxon signed rank test identified differences from survey 1 to survey 2. It was also critical to determine if changes were different for different groups. Because potential to change is often determined by the initial value, we compared groups using the survey 2 value as the outcome variable and the survey 1 value as the covariate. To determine which characteristics were predictive of the latent variables, multiple regression models were constructed using the latent variables as dependent variables and the characteristics as independent variables. We used the dichotomous bed-size variable (bed size 0–99; bed size ≥100) in one set of regression models (Table 3, Model 1); bed size was used as a quantitative variable in another set of regression models (Table 3, Model 2). Models where a specific latent variable is the dependent variable provide information about hospital characteristics predictive for

TABLE 1
Latent Variable Analysis*

Latent Variables	Mean	Median	Standard Deviation	Cronbach α
Computerized physician order entry (CPOE) systems, computerized test results, and assessments of adverse events	41.44	42	14.14	.89
Results of blood chemistries (e.g., drug levels) are systematically tracked and electronically sent to the pharmacy.				
According to policy/procedures, hospital assesses adverse events or patterns of adverse events during anesthesia use.				
There is a CPOE system for medications.				
There is a CPOE system for laboratory work.				
There is a CPOE system for radiology.				
There is a CPOE system for food service.				
The CPOE system at my hospital integrates medication, laboratory, radiology, and food service orders.				
Aggregate data are available to leaders to support managerial decisions and operations, performance improvement activities, and the provision of patient care.				
There is a computerized adverse drug event system.				
Specific patient safety policies	31.13	32	7.13	.76
Hospital has a written patient safety policy/plan/program.				
After an adverse event, quality improvements are identified, implemented, and monitored for effectiveness.				
A patient safety rounds/inspection program exists.				
Error prevention strategies target the system, not the individual practitioners (e.g., physicians, nurses, pharmacists).				
Errors are reported and openly discussed without fear of reprisal or undue embarrassment.				
There is a hospital-wide safety alert communication and dissemination system that gets information to the right people in a timely fashion.				
Use of data in patient safety programs	37.92	39	10.69	.82
Formats and methods for disseminating patient safety data and information are standardized.				
Patient safety intelligence from sources such as claims, compliments, complaints, and patient and employee/medical staff satisfaction data [is] integrated in quality improvement planning.				
Hospital collects and analyzes data regarding patient and staff suggestions for improving safety.				
Hospital takes action based on comparative information gathered from reference database(s).				
Physicians are routinely given performance feedback data that [are] related to patient safety issues.				
Coding staff assign e-codes to reflect patient injury and adverse events that occur during the hospital stay.				
Selected clinical codes obtained from the patients' medical records are used to develop measures for indicators of adverse events occurring at your facility.				
Clinical coding of adverse events at hospital is encouraged, including the appropriate assignment of e-codes.				

TABLE 1 continued

Latent Variables	Mean	Median	Standard Deviation	Cronbach α
Drug storage, administration, and safety procedures	73.00	74	12.17	.84
There is a hospital-approved standard set of abbreviations used by physicians and hospital staff.				
Practitioners (e.g., registered pharmacists, pharmacy technicians, nurses) involved in the medication process have at least 10 hours off duty between shifts worked.				
Unit-dose oral medications remain in the manufacturer's (or pharmacy's) packaging up to the point of actual drug administration at the bedside.				
The drug to be administered at the patient's bedside is checked against the patient's medication administration record.				
Commercially prepared premixed intravenous solutions are used whenever available.				
The systems used to physically deliver medications from the pharmacy to patient care units are directly controlled by the pharmacy using trained staff or automated delivery.				
Drugs stocked in patient care units are available in the least number of doses, concentrations, and forms that will meet essential patient needs for a 24-hour period.				
Certain potentially hazardous drugs are not available as floor stock (except in surgical/anesthesia stock).				
In critical care units, potentially hazardous drugs are sequestered from other floor stock medications and labeled with auxiliary warnings to clearly identify the drugs.				
Before high-alert drugs such as intravenous narcotics, intravenous insulin, chemotherapy, vasopressors, and pediatric/neonatal intravenous solutions are administered, one person readies the solution for administration and a second person independently verifies that the correct drug, drug concentration, rate of infusion, patient, and line attachment have been selected.				
Pharmacists validate the mg/kg or mg/m^2 dose for an order and double-check and document the prescriber's calculated dose before preparing and dispensing the drug.				
New drug orders are double-checked and documented by a pharmacist before being dispensed from the pharmacy.				
There is independent recording of adverse reactions to medications in the hospital pharmacy.				
Manner of handling adverse event/error reporting	14.53	16	5.38	.69
Reporting of adverse events can be anonymous.				
Reporting of adverse events is voluntary.				
Practitioners do not accumulate demerits or points for making a medication error.				
Prevention policies	7.79	8	4.07	.76
There is a written policy that addresses the prevention of adverse events.				
There is a written policy that specifically addresses the prevention of near-misses.				
Root-cause analysis (RCA)	15.41	17	4.96	.80
RCA is routinely conducted after a significant adverse sentinel event.				
An RCA is required after a near-miss.				
Near-misses are reviewed.				

* Individual variables included in each latent variable are listed below the variable.

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TABLE 2

Correlation Between Ordinal-Level Variables and Sum of Seven Latent Variables

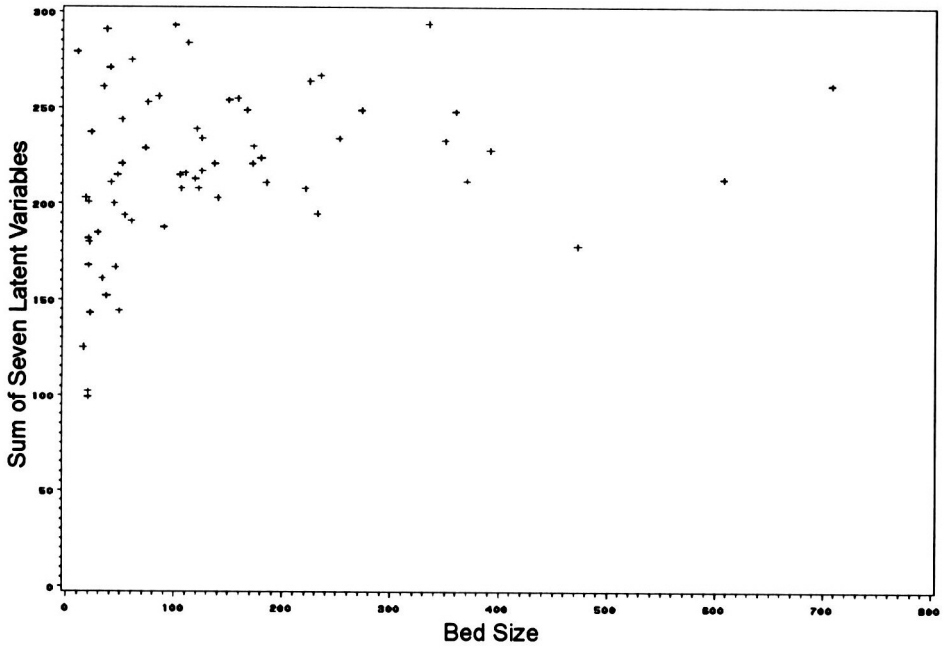
Variable	Correlation Coefficient	*p* Value*
Plans, policies, and programs		
Patient education policy—medication safety	.48	<.0001
Written patient safety plan	.53	<.0001
Standard formats, methods to disseminate patient safety data	.60	<.0001
Surgery patient education material provided	.36	.002
Use of Joint Commission Sentinel Event Alerts	.63	<.0001
Hospital-approved set of abbreviations	.44	<.0001
Post–adverse event quality improvement monitored	.62	<.0001
Post–adverse sentinel event root-cause analysis (RCA) conducted	.62	<.0001
Post–near-miss RCA required	.56	<.0001
Patient safety rounds program	.41	.0003
Leadership and environment		
Practitioners involved in the medication process work no more than 12 consecutive hours	.44	<.0001
Practitioners involved in medication process are off duty ≥ 10 hours between shifts	.55	<.0001
Systematic input from end users of technologies/supplies before purchase	.51	<.0001
Error prevention targets the system	.73	<.0001
Anonymous adverse event reporting	.55	<.0001
Voluntary adverse event reporting	.39	.0005
Errors reported without fear or reprisal	.62	<.0001
No demerits/points lost for making medical error	.70	<.0001
Thanks/praise for error detection/reports	.49	<.0001
Written adverse event prevention policy	.55	<.0001
Written near-miss prevention policy	.45	<.0001
Hospital-wide safety alert system	.58	<.0001
Employee patient safety/quality improvement continuing medical education program	.34	.0026
Minimum work conditions policy	.15	.19
Near-misses are reviewed	.50	<.0001
Data and computerization		
Computerized physician order entry system		
Medications	.55	<.0001
Laboratory work	.71	<.0001
Radiology	.62	<.0001
Food service	.62	<.0001
Integration of medication/lab/radiology/food service	.62	<.0001
Aggregate data available to support management decisions/operations/performance/patient care	.56	<.0001
Unit managers routinely given error rate report	.40	.0004

TABLE 2 continued

Variable	Correlation Coefficient	*p* Value*
Claims, compliments, complaints, and satisfaction data integrated in quality improvement planning	.45	<.0001
Failure mode and effects analysis conducted	.52	<.0001
Collect/analyze data regarding patient and staff suggestions for safety improvement	.40	.0003
Compare reference databases, then take action	.60	<.0001
Physicians routinely receive patient safety feedback data	.59	<.0001
Computerized adverse drug event system	.49	<.0001
Coding staff assign e-codes to reflect patient injury/adverse events	.57	<.0001
Clinical codes from medical records used to develop adverse indicators	.52	<.0001
Adverse events clinical coding encouraged (e-codes)	.50	<.0001
Surgery		
Policy: clinicians discuss anesthesia options/risks with patient/family before surgery	.40	.0003
Policy: assess anesthesia adverse events/patterns	.50	<.0001
When multiple procedures are conducted in one session, each surgeon obtains consent	.32	.007
Medications		
Unit-dose oral medications remain in package until given	.48	<.0001
Medications at bedside are checked against patient's medication administration record	.47	<.0001
Buy, use premixed intravenous solutions	.64	<.0001
Pharmacy controls drug delivery to units with trained staff or automation	.71	<.0001
Stock drugs in units, in lowest number of doses/concentrations needed for 24 hours	.70	<.0001
Potentially hazardous drugs are not available as floor stock (except in surgical/anesthesia)	.61	<.0001
Potentially hazardous drugs are isolated from other floor stock medications and with warning labels	.53	<.0001
For high-alert drugs, separate persons would ready solution and verify correct patient, concentration, infusion rate, line attachment	.54	<.0001
Pharmacists validate mg/kg or mg/m^2 dose, double-check/document prescriber's dose before drug preparation and dispensing	.50	<.0001
New drug orders are double-checked and documented by pharmacist before dispensing	.44	<.0001
Pharmacy independently records adverse reactions to medications	.67	<.0001
Blood chemistries systematically tracked and electronically sent to pharmacy	.56	<.0001

*Spearman correlation.

FIGURE 1
Plot of the Sum of the Latent Variables by Hospital Bed Size



that construct. Models where the sum is the dependent variable permit examination of hospital characteristics predictive of the overall level of system implementation.

RESULTS

For each organizational characteristic investigated, we first present results relative to hospital organizational characteristics for each of the two surveys. We then present results of the Wilcoxon signed rank test, which were used to examine change scores within each group for the eight outcome variables. Finally, we present a between-group comparison of change, using the survey 2 value as the outcome variable and the survey 1 value as a covariate.

Bed Size

For the latent variable "computerized physician order entry systems, computerized test results, and assessments of adverse events," the Wilcoxon rank sum test showed a significant difference between smaller (0–99 beds) and larger hospitals (≥100 beds) on both surveys (p <.0001, survey 1; p = .0002, survey 2). A significant difference between the two bed-size groups was found only for survey 1 for the latent variables "use of data in patient safety programs" (p = .03) and "root-cause

TABLE 3
Results of Regression Analysis

Dependent Variable	Independent Variable	*p* Value*			
		Survey 1		Survey 2	
		Model 1†	Model 2‡	Model 1†	Model 2‡
Computerized physician order entry systems, computerized test results, and assessments of adverse events	Model	<.0001	<.0001	<.0001	<.0001
	Accreditation status	<.0001	<.0001	.002	.003
Use of data in patient safety programs	Model	.007	.02		
	Management type§	.009	.02		
Drug storage, administration, and safety procedures	Model	<.0001	<.0001	.04	
	Management type§	.03	.01		
	Accreditation status	<.0001	.0002	.002	
Prevention policies	Model			.04	.04
	Rural/urban status			.009	.007
Root-cause analysis	Model	.0003	.001	.0003	.0009
	Management type§			.03	.03
	Rural/urban status			0.047	
	Accreditation	.002	.0007	.003	.002
Sum of seven latent variables	Model	<.0001	<.0001	.001	.002
	Management type§	.0009	.02		
	Accreditation status	.0003	.0001	.003	.002

* For all variables with a significant *p* value in the model, the associated coefficients were positive.
† In Model 1, bed size is a dichotomous variable.
‡ In Model 2, bed size is a continuous variable, and the quadratic term of bed size is also used.
§ Refer to Table 4 to determine which of the management types are significant predictors.

analysis" (p = .004). In all cases, larger hospitals had the higher mean value. For the summary measure, the difference was significant at both points in time (p = .007, survey 1; p = .04, survey 2); again, the larger hospitals had the higher mean values. To examine differences relative to bed size, Spearman's

correlation was used with bed size as a quantitative variable. For the latent variable "computerized physician order entry systems, computerized test results, and assessments of adverse events," bed size was significantly and positively correlated with implementation level (p <.0001 for both survey 1 and survey 2), indicating that hospitals with more beds had a higher level of implementation of the safety systems related to that latent variable. Significant positive correlations were found for survey 1 only, for three latent variables: "use of data in patient safety programs" (p = .03); "drug storage, administration, and safety procedures" (p = .04); and "root-cause analysis" (p = .003); hospitals with a larger bed size had higher system implementation levels. Bed size was significantly and positively correlated with the sum of the seven latent variables for survey 1 (p = .002), but not for survey 2.

Two bed-size groups were significantly different in change over time for the latent variable "computerized physician order-entry systems, computerized test results, and assessments of adverse events" (p = .0452), with smaller hospitals (0–99 beds) having the higher mean value; however, change within each of the two groups was not statistically significant. This was the only variable for which a between-group difference was found relative to bed size. Significant within-group differences in change were found for one or both bed-size groups on five latent variables: "specific patient safety policies" (p = .001 for 0–99 beds), "use of data in patient safety programs" (p = .004 for 0–99 beds, p = .04 for ≥100 beds), "manner of handling adverse event/error reporting" (p = .01 for 0–99 beds), "prevention policies" (p = .006 for 0–99 beds, p = .01 for ≥100 beds), and "root-cause analysis" (p = .008 for 0–99 beds). For the summary measure there was a significant within-group difference for larger hospitals (p = .03), but there was no significant within-group difference for smaller hospitals or between the two groups.

Management Type

Hospitals were grouped by management type, as state/local government; nongovernment, not-for-profit; or investor-owned, for profit. For variables on which a statistically significant difference was found, posthoc comparisons were done, using the Wilcoxon rank sum test to pinpoint which pairs of groups were different. Statistically significant differences were found for survey 1 only, for two latent variables: "use of data in patient safety program" (p = .04), for which state/local government hospitals had the highest mean value and nongovernment, not-for-profit hospitals had the lowest; and "drug storage, administration, and safety procedures" (p = .03), for which investor-owned, for-profit hospitals had the highest mean value and nongovernment, not-for-profit hospitals had the lowest. Significant differences were found for survey 2 only, for two latent variables: "computerized physician order-entry systems, computerized test results, and assessments of adverse events" (p = .03) and "root-cause analysis" (p = .04). In both cases, nongovernment, not-for-profit hospitals had the highest mean value and

state/local government hospitals had the lowest. In all four cases, posthoc comparisons pinpointed statistically significant difference between the group with the highest mean value and the group with the lowest mean value (see Table 4).

Additional analyses found statistically significant within-group differences in change over time for all seven latent variables as well as for the summary measure (p <.0001) for nongovernment, not-for-profit hospitals. A within-group difference was found on one latent variable ("computerized physician order entry systems, computerized test results, and assessments of adverse events") for state/local government hospitals. When survey 2 data were adjusted for survey 1 data, a statistically significant between-group difference was found for the latent variable "computerized physician order entry systems, computerized test results, and assessments of adverse events" (p = .002): nongovernment, not-for-profit hospitals had the highest mean value and state/local government hospitals had the lowest. A between-group difference was found for "root-cause analysis" (p = .02): nongovernment, not-for-profit hospitals had the highest mean value and investor-owned, for-profit hospitals had the lowest. A between-group difference was also found for the summary measure (p = .04): nongovernment, not-for-profit hospitals had the highest mean value and investor-owned, for-profit hospitals had the lowest. In all three instances the lowest mean value was negative, indicating that some hospitals reported a lower level of implementation for survey 2 than for survey 1.

Posthoc comparisons using the Wilcoxon rank sum test showed significant differences in change between state/local government hospitals and nongovernment, not-for-profit hospitals on the latent variables of "computerized physician order entry systems, computerized test results, and assessments of adverse events" (p = .001) and "root-cause analysis" (p = .03) and on the sum of the latent variables (p = .0466). A statistically significant difference was found between nongovernment, not-for-profit hospitals and investor-owned, for-profit hospitals on the latent variable "root-cause analysis" (p = .0450).

Urban or Rural Location

Significant differences between urban and rural hospitals were found at both survey times for "computerized physician order entry systems, computerized test results, and assessments of adverse events" (p <.0001, survey 1; p = .0002, survey 2); in both cases, urban hospitals had the higher mean value. For the variable "use of data in patient safety programs," a significant difference was found for survey 1 only (p = .01); urban hospitals had the higher mean value. For "manner of handling adverse event/error reporting," significant differences were found at both times (p = .02 for survey 1 and p = .03 for survey 2); in both cases, urban hospitals had the higher mean value. Significant differences were found at both times for the summary measure (p = .001, survey 1; p = .04, survey 2); in both cases, urban hospitals had the higher mean value.

TABLE 4

Least Square Means and *p* Values for Independent Variables for Which Management Category Is Statistically Significant in the Regression Model

Dependent Variable			Least Square Means			*p* Value		
			State/Local Government	Nongovernment, Not-for-Profit	Investor-Owned, For-Profit	State/Local Government vs. Nongovernment, Not-for-Profit	State/Local Government vs. Investor-Owned, For-Profit	Nongovernment, Not-for-Profit vs. Investor-Owned, For-Profit
Use of data in patient safety programs	Survey 1	Model 1†	42	34	40	.0054	.7165	.0556
		Model 2‡	41	34	39	.0076	.5742	.1052
Drug storage, administration, and safety procedures	Survey 1	Model 1†	72	66	74	.0327	.7346	.0406
		Model 2‡	73	66	75	.0252	.6091	.0208
Root-cause analysis	Survey 2	Model 1†	14	17	15	.0127	.5459	.1747
		Model 2‡	14	17	15	.0118	.6014	.1367
Sum of 7 latent variables	Survey 1	Model 1†	216	191	225	.024	.5526	.0107
		Model 2‡	215	191	222	.0291	.6745	.0201

†In Model 1, bed size is a dichotomous variable.

‡In Model 2, bed size is a continuous variable, and the quadratic term of bed size is also used.

Statistically significant within-group differences in change over time were found for urban hospitals on "use of data in patient safety programs" (p = .04) and "prevention policies" (p = .02), as well as on the summary measure (p = .03). Within-group differences were found for rural hospitals on "specific patient safety policies" (p = .003), "use of data in patient safety programs" (p = .01), "manner of handling adverse event/error reporting" (p = .03), "prevention policies" (p = .001), and "root-cause analysis" (p = .005). No statistically significant between-group differences were found after adjusting for survey 1 data.

Accreditation Status

In comparing Joint Commission–accredited hospitals with hospitals not accredited by the Joint Commission, significant differences were found at both times for the latent variables of "computerized physician order entry systems, computerized test results, and assessments of adverse events" (p <.0001, both survey 1 and survey 2); "drug storage, administration, and safety procedures" (p <.0001, survey 1; p = .01, survey 2); and "root-cause analysis" (p = .0002, survey 1; p = .02, survey 2). In all cases, Joint Commission–accredited hospitals had the higher mean value. Statistically significant differences were found for survey 1 only, for three other latent variables: "specific patient safety policies" (p = .0497), "use of data in patient safety programs" (p = .03), and "manner of handling adverse event/error reporting" (p = .004); again, Joint Commission–accredited hospitals had the higher mean value. For the summary measure there was a significant difference at both times (p <.0001, survey 1; p = .0007, survey 2) and Joint Commission–accredited hospitals had the larger mean value.

Examining change scores for Joint Commission–accredited and hospitals not accredited by the Joint Commission (from here on called "nonaccredited"), we found statistically significant within-group differences for "specific patient safety policies" (p = .01 for accredited, p = .01 for nonaccredited), "use of data in patient safety programs" (p = .01 for accredited), "manner of handling adverse event/error reporting" (p = .01 for nonaccredited), "prevention policies" (p = .001 for accredited), and "root-cause analysis" (p = .03 for nonaccredited), as well as for the summary measure (p = .01 for accredited). Comparing the two hospital groups, after adjusting survey 2 data for survey 1 data, statistically significant differences between accredited and nonaccredited hospitals were found on the latent variable of "computerized physician order entry systems, computerized test results, and assessments of adverse events" (p = .03) and on the summary measure (p = .03). Consistently, Joint Commission–accredited hospitals had both a higher level of safety system implementation and a higher level of improvement in implementation than did nonaccredited hospitals.

Regression Results

Organizational characteristics investigated as independent variables in regression models were size as a dichotomous (Table 3, Model 1) and quantitative (Table 3, Model 2) vari-

able; management type (three categories, two dummy variables), urban/rural status, and Joint Commission accreditation status. Univariate analyses of these variables with the latent variables and summary measure provided sufficient evidence that they should be considered as possible predictor variables. Regression analyses are presented in Tables 3 and 4. For the dependent variable—the sum of the latent variables—all four models were highly significant, and in each case accreditation status was the strongest predictor. For the two survey 1 models, management type was also a significant predictor. Most of the models where individual latent variables were dependent variables were also significant; in most cases accreditation status was a significant predictor. Management type and urban/rural status were significant predictors in a few of the models. Although our initial analyses suggested that bed size might be an important predictor, when put in the model with accreditation it was not significant. Results indicate that accreditation is the dominant hospital characteristic related to level of safety system implementation, and management type and urban-rural status play minor roles.

DISCUSSION

This article aims to identify organizational characteristics of hospitals that have implemented patient safety systems more extensively than others. Many of the key patient safety systems we studied are addressed in Joint Commission accreditation requirements (Joint Commission 2007a, 2007b), as well as in standards from such organizations as the Leapfrog Group (Birkmeyer and Dimick 2004) and the National Quality Forum (2005). We found that, for both univariate and multivariate analyses, Joint Commission accreditation was uniformly, strongly, and consistently associated with more extensive implementation of patient safety systems, both at specific points in time and with respect to change over time. Accreditation status was the only organizational characteristic that consistently emerged in identifying which hospitals have more extensively implemented patient safety systems. Using the summary measure, we found that accredited hospitals had statistically significant improvement ($p = .01$), while nonaccredited hospitals did not ($p = .21$). Comparing accredited with nonaccredited hospitals at time 2, covarying on time 1, also showed a significant difference: Joint Commission–accredited hospitals had larger mean values. Overall, Joint Commission accreditation status was the key predictor of hospital patient safety system implementation.

We recognize that most of the organizational characteristics we examined, such as management category, are not easily changed and that although accreditation status can be changed, Joint Commission accreditation involves a number of requirements that may take time for hospitals to implement. Many factors determine Joint Commission accreditation, such as a hospital's willingness and ability to meet Joint Commission standards and pay a substantial accreditation survey fee. We also recognize that hospitals

can implement patient safety systems without necessarily becoming accredited. Hospitals that have more patient safety systems in place, however, may find it easier to meet accreditation criteria; this may explain, in part, the association of accreditation with safety system implementation. Thus, while accreditation is a predictor of safety system implementation, our study is limited in that it cannot confirm that there is a cause-and-effect relationship, nor can it indicate the direction of such a relationship if indeed it exists. Also, findings from this study of acute care hospitals in two states may have limited generalizability for hospitals nationwide. Nevertheless, our data appear to support findings of studies by Devers, Pham, and Liu (2004) and Wachter (2004), which identified Joint Commission accreditation as a catalyst for patient safety progress.

Several factors may account for these findings. First, in 2002 the Joint Commission proposed tying accreditation to meeting patient safety goals (Watt et al. 2003); the plan began to be implemented in 2003. The Joint Commission proposed in 2002 and began in 2003 to tie accreditation to meeting patient safety goals. This was a substantial change from 1999, when the Office of Inspector General, in its review of the Joint Commission, reported that "it [the Joint Commission] remains of little value to external assessments of quality" and issued a call for greater accountability (Brown 1999). Although the Office of Inspector General's role in changing the Joint Commission may be debated, the 2003 changes profoundly altered the nature and influence of Joint Commission accreditation. The Joint Commission revised its standards, directing almost 50 percent of its criteria to patient safety. In addition, the Joint Commission developed annual national safety goals (Joint Commission 2007a, 2007b). These explicit, measurable goals are now a critical component of accreditation and, with the potential penalty of nonaccreditation for hospitals not meeting the goals, provide a stronger incentive than any previous approach to motivate compliance. Although the Joint Commission is a voluntary not-for-profit accreditation agency, because of its Medicare "deemed status" (accreditation guarantees Medicare payments to hospitals), it substitutes for hospital licensure in many states.

Additionally, specific accreditation findings are now publicly available; previously, consumers could only find out if a hospital was accredited, but no further performance data were published. The Joint Commission developed its Quality Check web site (www.qualitycheck.org) to provide such data directly to consumers. *Consumer Reports on Health*, published by the respected "watchdog" agency Consumers Union (2004), cited it as a source consumers should consult in making decisions regarding hospitalization. The combined effect of stronger accreditation standards and the initiation of public reporting of accreditation findings may explain our study findings and the small but growing body of literature pointing to Joint Commission accreditation as a facilitator in changing hospital behavior, particularly with respect to patient safety systems.

Strong empirical evidence points to the influence of both regulation and the release of hospital data on hospital behavior. However, for the benefit to be fully realized, regulators must have power to influence or change the behavior of hospitals with regard to quality and patient safety and must use such power in the public interest (Grant and Tellis-Nayak 2004; Mello, Kelly, and Brennan 2005).

As a significant step toward meeting the challenge of the IOM report, healthcare executives, hospital trustees, state and federal regulators, and policymakers should encourage Joint Commission accreditation and reward all hospital efforts toward meeting Joint Commission standards. For its part, the Joint Commission should continually strive to maintain evidence-based and state-of-the-art standards that advance the aim of providing the best possible care for hospitalized patients.

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PRACTITIONER APPLICATION

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The conclusion reached by the authors that Joint Commission accreditation is a predictor of implementation of hospital patient safety systems should be

reassuring to hospital leadership teams. This is especially interesting in light of the fact that the authors conducted this study to answer the next logical question in their examination of patient safety systems: What are the characteristics of hospitals that do well in implementing a patient safety system? The answer to this has great importance for hospital administrators as well as for policymakers and patients.

This study's findings come at a time when, while certainly well intentioned, the ever-increasing number of organizations exhorting hospitals to adopt ever-increasing numbers of patient safety initiatives is bordering on the unmanageable. A number of these organizations are operating without a portfolio (and certainly without providing funding to hospitals to adopt their sometimes arcane recommendations). As a result many hospitals spend tremendous time, effort, and resources on trying to comply with countless recommendations and standards. Often these efforts lack coordination and give rise to questions about their ultimate efficacy. Indeed, physicians and other members of the clinical team are increasingly questioning whether a "forest through the trees" syndrome is occurring.

The Joint Commission, despite some missteps over the years, provides a credible, rational forum for adopting standards to continually advance the patient safety agenda. Through its board composition, standard development processes, increasingly sophisticated data management capabilities, and commitment to enhanced communication, the Joint Commission provides a degree of rationality in an increasingly complex arena. Further, through the "deemed status" provision, many hospitals rely on Joint Commission accreditation to demonstrate compliance with Centers for Medicare and Medicaid Services and state department of health regulations. Thus, the study's findings reassure us hospital administrators that Joint Commission accreditation clearly makes a difference and is worth the necessary effort.

Critics of the Joint Commission are justified in expressing concerns about the possibility of conflicts of interest, given that physicians and hospitals are heavily represented on the Joint Commission board. This fact should motivate hospitals, as well as the leadership of the Joint Commission, to take every possible step to avoid any possible conflicts as the organization provides a vital role not only to hospitals but also to the patients and communities we serve. Further, the study findings reinforce the fact that the many changes the Joint Commission has enacted over the past decade have been pointed in the right direction. By incorporating real "teeth" into its patient safety standards as well as into its accreditation process, the Joint Commission provides the motivation for hospitals nationwide to follow its lead. This is a public trust that the Joint Commission must keep sacred.

Patient safety must be an integral part of the mission of every hospital in the United States. The authors should be applauded for bringing intellectual rigor to a vitally important and emotionally charged issue.