Medication Safety

Assessing the State of Safe Medication Practices Using the ISMP Medication Safety Self Assessment® for Hospitals: 2000 and 2011

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Harmful medication errors represent a serious concern. Americans fill an average of 12 prescriptions per person per year, totaling more than 4 billion prescriptions annually.[1] Hospitalized patients receive about 20 medication doses daily and are subjected to one medication error per day.[2] Medication errors cause at least one death every day and injure 1.3 million people annually.[3] Ubiquitous use of medications,[2] the increasing complexity of certain medication regimens, the high rate of nonadherence with prescribed medications,[4] and an ever-increasing supply of products have made medication errors the most common cause of harm during the delivery of health care.[2,5]

To help address this growing national crisis, the Institute for Safe Medication Practices (ISMP), in partnership with the American Hospital Association (AHA) and the Health Research & Educational Trust (HRET), launched the first ISMP Medication Safety Self Assessment® for Hospitals in 2000.[6] The Assessment was one of the earliest collaborative efforts in the United States following the Institute of Medicine's 1999 landmark report, *To Err Is Human*,[5] which, in bringing medical errors closer to a national priority, provided momentum for the Assessment. As described by Smetzer et al., more than 1,400 hospitals in the United States voluntarily completed the 2000 Assessment and submitted findings anonymously and confidentially to ISMP.[6] The 2000 Assessment established a national baseline measurement of hospitals' efforts to enhance medication safety.[6] The intention was to repeat the Assessment every 5 to 10 years to demonstrate change. Since 2000, the Assessment has been used by individual hospitals and collaborative groups to improve safety in the United States[7–9] and globally.[10–17]

In 2004 ISMP released an updated Medication Safety Self Assessment for Hospitals, for which more than 1,600 hospitals submitted results to ISMP. The 2004 Assessment demonstrated a 16% improvement in the overall score compared to the 2000 Assessment, with larger improvements in key areas such as organizational culture (41% improvement), educating patients about medications (25%), managing look- and sound-alike

Article-at-a-Glance

Background: Since development of the Institute for Safe Medication Practices (ISMP) Medication Safety Self Assessment® for Hospitals in 2000, hospitals have used the tool to assess medication safety practices and identify opportunities for improvement. The Assessment was updated in 2011 to create a new baseline of hospital medication safety efforts and determine if progress has been achieved in the interim.
Methods: Hospitals in the United States were asked to voluntarily complete the 2011 Assessment and submit their data confidentially to ISMP from April to October 2011. The Assessment contained 270 items organized into 10 key elements and then further divided into 20 core characteristics.
Results: By October 2011, 1,310 hospitals had submitted data to ISMP for a response rate of 23% for all 5,786 hospitals. Scores in 2011 increased significantly from 2000. The largest percent improvements were in core characteristics related to communication of drug orders, patient education, and quality processes and risk management. Hospitals in 2011 scored lowest in areas related to patient information, staff competency and education, and drug information. Higher scores for the core characteristics related to the organizational culture and staff education about medication error prevention were associated with higher scores for the core characteristic associated with error detection, reporting, and analysis. Hospitals with a medication safety officer scored higher in all key elements than hospitals without.
Conclusions: While substantial medication safety improvements have been achieved within the last decade, opportunities still exist to improve medication safety. Widespread adoption of key safety strategies will be more effective if influential groups work together and external forces provide the necessary pressure via regulations, standards, public policy, or incentives.

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medications (29%), and making essential information about the patient available (26%).[6,18]

Following launch of the 2004 ISMP Medication Safety Self Assessment for Hospitals, an Institute of Medicine special report in 2006 on medication errors suggested that, despite progress in patient safety since *To Err Is Human*,[5] medication errors remained common and health care systems could do more to prevent them.[2] In 2002 The Joint Commission released National Patient Safety Goals,[19,20] many of which concerned medication safety; the World Health Organization developed a checklist to verify patient information prior to surgery[21]; and the Agency for Healthcare Research and Quality (AHRQ) and the US Department of Defense released an evidence-based teamwork system, TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety), to improve communication among health professionals.[22] For its part, ISMP identified significant risks associated with medication use that were not previously addressed in the 2000 and 2004 Assessments, including error-prone use of nonmetric measurement systems (for example, pounds versus kilograms, teaspoons versus mL),[23] inappropriate dosing of opioids,[24] system-induced at-risk behaviors,[25] and inappropriate postoperative intravenous solutions for children that had caused fatal hyponatremia and water intoxication.[26]

In 2010, ISMP, AHA, and HRET again received funding through The Commonwealth Fund to update the Assessment, which was endorsed by 24 key national organizations (including The Joint Commission) and released in April 2011.[27] The goals of the 2011 Assessment were to heighten awareness of the most up-to-date best practices associated with safe medication use; to document medication safety progress in hospitals in the United States; and to encourage local, state, and national initiatives and public policy intended to further improve medication safety.

In this article, we compare findings from the 2011 ISMP Medication Safety Self Assessment for Hospitals and the 2000 Assessment[6] and describe the three key elements that demonstrated the greatest improvement. We also present the three lowest-scoring key elements of medication safety from the 2011 Assessment to demonstrate where continued improvements are most needed, along with analysis of how hospital demographics, organizational culture, staff education, the cost and difficulty of implementing strategies, and the presence of a medication safety officer impacted Assessment scores.

Methods

Instrument

The 2011 ISMP Medication Safety Self Assessment for Hospitals is composed of 270 items organized into 10 key elements (which we called *domains* when reporting the 2000 results[6]) and 20 core characteristics representative of safe medication use (Table 1, pages 53–55). Each Assessment item had five possible responses:

A. There has been no activity to implement this item.

B. This item has been formally discussed and considered, but it has not been implemented.

C. This item has been partially implemented in some or all areas of the organization.

D. This item is fully implemented in some areas of the organization.

E. This item is fully implemented throughout the organization.

Numeric values were assigned to each response choice (A through E) using a scale of 0 to 16. Some items also included a choice of *Not Applicable* for services (for example, pediatrics, oncology) not offered by the hospital, or specific items on metrics from technology not engaged by the hospital. Different items had a different maximum value assigned to the response choices, depending on their evidence base, impact on patient safety, and their ability to sustain improvement. For example, item 199, which dealt with encouraging patients to ask questions, had the following value assignment: A (no activity) = 0; B (considered but no activity) = 0; C (partial implementation) = 2; D (full implementation in some areas) = 3; E (full implementation throughout) = 4. In contrast, item 202, which dealt with automatic consultations to pharmacists for patient education, had the following value assignment: A = 0, B = 0, C = 4, D = 6, E = 8. These numeric values were not known to respondents.

An advisory panel of experts who were highly knowledgeable in hospital practices and medication safety issues helped inform and verify the Assessment content and establish validity of the instrument. Cronbach's alpha was computed for the key elements and core characteristics to test internal reliability of the instrument.

Instrument Distribution and Data Collection

In April 2011, the HRET Institutional Review Board approved the study. ISMP posted the Assessment on its website (http://www.ismp.org) and, along with organizations that endorsed the Assessment, notified hospitals about its availability via US mail, e-mail, newsletters, and journal articles. In addition, the president of the AHA sent an e-mail to the chief executive officer of each hospital, introducing the Assessment and encouraging its use.

Hospitals were instructed to visit ISMP's website to obtain a randomly assigned password generated by a Web-based program, allowing for anonymity of the data. Directions for completing

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Table 1. 2011 Key Elements, Core Characteristics, and Self Assessment Items (Highest and Lowest Scoring)*

Key Elements	Core Characteristics	Highest- and Lowest-Scoring Self Assessment Items Within Each Core Characteristic	Mean (%)
I. Patient Information	**1)** Essential patient information is obtained, readily available in useful form, and considered when prescribing, dispensing, and administering medications, and when monitoring the effects of medications.	**2:** Pharmacists can easily and electronically access inpatient laboratory values while working in their respective clinical locations.	97
		24: Medication orders cannot be entered into the computer order entry system until the patient's weight has been entered (i.e., orders cannot be entered until the weight field has been populated).	17
II. Drug Information	**2)** Essential drug information is readily available in useful form and considered when prescribing, dispensing, and administering medications, and when monitoring the effects of medications.	**31:** Pharmacists and pharmacy technicians have easy access to user-friendly, up-to-date, computerized drug information systems, which include information on over-the-counter, herbal, and alternative medicines.	97
		44: A designated pharmacist routinely reviews, for quality improvement purposes, reports of selected computer order entry system warnings (e.g., maximum dose alerts, serious drug interactions, allergy alerts) that are overridden.	29
	3) A controlled drug formulary system is established to limit choice to essential drugs, minimize the number of drugs with which practitioners must be familiar, and provide adequate time for designing safe processes for the use of new drugs added to the formulary.	**53:** The hospital's ability to adequately monitor and manage the anticipated adverse effects of a medication is investigated and considered by the pharmacy and therapeutics committee (or other interdisciplinary team), and addressed before adding the medication to the formulary.	89
		58: In non-urgent situations, formulary medications being considered for uncommon uses or in atypical doses are approved through a formal review process (e.g., pharmacy and therapeutics committee) before prescribers order the drug.	57
III. Communication of Drug Orders and Other Drug Information	**4)** Methods of communicating drug orders and other drug information are streamlined, standardized, and automated to minimize the risk for error.	**71a and b:** Computer generated or electronic medication administration records that share a common database with the pharmacy system are used to guide and document medication administration.	93
		68: Verbal (face-to-face) orders from prescribers who are onsite in the hospital are never accepted, except in emergencies or during sterile procedures where ungloving would be impractical.	44
IV. Drug Labeling, Packaging, and Nomenclature	**5)** Strategies are undertaken to minimize the possibility of errors with drug products that have similar or confusing manufacturer labeling/packaging and/or drug names that look and/or sound alike.	**78:** The ISMP Medication Safety Alert! and/or other current literature is regularly reviewed to identify drug labeling, packaging, and nomenclature problems, and action is taken to prevent errors with these drugs.	91
		86: Prescribers include the clinical indication for all ambulatory prescriptions and inpatient drug orders to help distinguish those with look-alike names.	31
	6) Readable labels that clearly identify drugs are on all drug containers, and drugs remain labeled up to the point of actual drug administration.	**95:** The drug name on the labels of patient-specific medications or unit doses dispensed from the pharmacy can be matched with the corresponding drug name on the MAR, even when therapeutic substitutions are dispensed (e.g., the MAR and label reflect the therapeutic substitution; or the label on the therapeutic substitution lists the product for which it is being substituted.	94
		94: Doses that require less than a full tablet (e.g., ½ or ¼ tablet, 1½ tablets) are repackaged by the pharmacy into unit-dose packages.	42
V. Drug Standardization, Storage, and Distribution	**7)** IV solutions, drug concentrations, doses, and administration times are standardized whenever possible.	**96:** Concentrations for infusions of high-alert drugs such as morphine, heparin, insulin, and vasopressors used for adult patients are standardized to a single concentration that is used in at least 90% of the cases.	95
		98: When more than one standardized concentration is needed for high-alert infusions (for adults or pediatrics), the organization uses consistent terminology (e.g., double strength, quadruple strength) and visual cues to identify and distinguish between the concentrations when communicating drug information (including labels, handwritten or preprinted orders, MARs, chart notations, and electronic formats, including computer screens).	75

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Table 1. 2011 Key Elements, Core Characteristics, and Self Assessment Items (Highest and Lowest Scoring) (continued)

Key Elements	Core Characteristics	Highest- and Lowest-Scoring Self Assessment Items Within Each Core Characteristic	Mean (%)
V. Drug Standardization, Storage, and Distribution (continued)	**8)** Medications are provided to patient care units in a safe and secure manner and available for administration within a time frame that meets essential patient needs.	**103:** Sufficient numbers of ADCs, depending on their intended use (e.g., limited narcotic and unit stock versus total drug distribution), are installed in areas that are easily accessible to staff and in close proximity to patients to ensure access without unreasonable wait times and to reduce workarounds. (*Not scored by hospitals without ADCs.*)	92
		104: Nurses are notified whenever first dose or stat medications are delivered to the unit when they are not otherwise available on the unit (e.g., in an ADC).	58
	9) Unit stock is restricted.	**120:** Pharmaceutical vendors and prescribers are prohibited from distributing drug samples in inpatient and outpatient areas, including EDs, ambulatory surgery/procedure units, and radiology.	95
		118: Medications are not removed from outpatient (including the ED, ambulatory surgery, outpatient oncology) unit stock (including ADCs) before a pharmacist reviews the specific patient order and screens the order for safety. Exception: Urgent or lifesaving situations where a delay would harm the patient.	48
	10) Hazardous chemicals are safely sequestered from patients and not accessible in drug preparation areas.	**128:** Containers of reagents used to test for fecal blood (e.g., Hemoccult, Seracult) or glucose control solution (reagents used with glucose monitors) are not present in drug storage or preparation areas, patient rooms, or patient bathrooms.	84
		126: Bulk chemicals used in the pharmacy (for compounding) are labeled with contents, the date the product was first opened, and the manufacturer's expiration date. (If an expiration date is unavailable from the manufacturer, a 1-year expiration date is assigned.)	72
VI. Medication Device Acquisition, Use, and Monitoring	**11)** The potential for human error is mitigated through careful procurement, maintenance, use, and standardization of devices used to prepare and deliver medications.	**133:** Specially designed oral syringes, which cannot be connected to parenteral tubing, are available in the pharmacy and all patient care units, and are used for dispensing/administering oral/enteral liquid medications that are not available in commercially prepared unit-dose cups.	89
		147: If smart pump technology is used, an interdisciplinary team, which includes pharmacists, nurses, and physician representatives, develops and tests the drug library, and reviews and updates the library at least quarterly. (*Not scored by hospitals not using smart pumps.*)	48
VII. Environmental Factors, Workflow, and Staffing Patterns	**12)** Medications are prescribed, transcribed, prepared, dispensed, and administered within an efficient and safe workflow and in a physical environment that offers adequate space and lighting, and allows practitioners to remain focused on medication use without distractions.	**149:** Lighting is adequate (illumination levels around 100 foot-candles) to clearly read labels and other important drug and patient information in pharmacies, patient unit medication rooms, patient rooms, and at ADCs.	93
		154: Areas where drug orders are transcribed and/or entered into computer order entry systems are isolated and relatively free of distractions, interruptions, and noise (not greater than 50 dBA).	53
	13) The complement of qualified, well-rested practitioners matches the clinical workload without compromising patient safety.	**159:** Medical students, medical residents, attending physicians, and other licensed independent practitioners work no more than 24 consecutive hours, with planned protected sleep periods and naptime available. Exception: Isolated emergency situations outside of usual operations. (*Not scored by hospitals without students, residents, or employed prescribers.*)	90
		165: Nurses believe that staffing patterns on their units are adequate to provide safe patient care on most days.	73

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Table 1. 2011 Key Elements, Core Characteristics, and Self Assessment Items (Highest and Lowest Scoring) (continued)

Key Elements	Core Characteristics	Highest- and Lowest-Scoring Self Assessment Items Within Each Core Characteristic	Mean (%)
VIII. Staff Competency and Education	**14)** Practitioners receive sufficient orientation to medication use and undergo baseline and annual competency evaluation of knowledge and skills related to safe medication practices.	**178:** The hospital only allows practitioners who are trained in the use of drugs causing deep sedation, qualified to rescue patients from general anesthesia or severe respiratory depression, and not simultaneously involved in a procedure, to administer medications which could lead to deep sedation (e.g., propofol, ketamine, etomidate) of non-ventilated patients. (Advanced cardiac life support [ACLS] certification alone is not sufficient.)	92
		173: During orientation, nurses spend time in the pharmacy (and with clinical pharmacists) to become familiar with the order entry and/or verification process, drug preparation and dispensing, availability of drug information resources, ways to access these resources, and various medication safety initiatives.	22
	15) Practitioners involved in medication use are provided with ongoing education about medication error prevention and the safe use of drugs that have the greatest potential to cause harm if misused.	**189:** Practitioners are trained in the clinical and administrative procedures for responding to a serious medication error.	81
		192: Simulations of error-prone conditions (e.g., problematic medication packages and labels, mock transcription/order entry of problematic orders) and/or role-playing (e.g., to teach effective communication skills, inquiry skills, conflict resolution) are used as methodologies to orient and educate practitioners and other staff about medication/patient safety.	38
IX. Patient Education	**16)** Patients are included as active partners in their care through education about their medications and ways to avert errors.	**199:** Patients are encouraged to ask questions about the medications they are receiving.	92
		202: Criteria have been established (e.g., selected high-alert drugs, high-risk patient populations) to trigger an automatic consultation with a pharmacist for patient education.	29
X. Quality Processes and Risk Management	**17)** A safety-supportive Just Culture and model of shared accountability for safe system design and making safe behavioral choices is in place and supported by management, senior administration, and the Board of Trustees/Directors.	**222:** There is a visible commitment to patient safety within the organization that is evident in the behaviors of hospital leaders and managers.	90
		219: Units with a high error reporting rate are praised for detecting and reporting errors.	38
	18) Practitioners are stimulated to detect and report adverse events, errors (including close calls), hazards, and observed at-risk behaviors, and interdisciplinary teams regularly analyze these reports as well as reports of errors that have occurred in other organizations to mitigate future risks.	**235:** Practitioners who have been directly involved in a serious or potentially serious medication error participate in a root cause analysis (RCA) of that error and assist with the development of system design enhancements to reduce the potential for future errors.	91
		246: Patient representatives from the community are invited to participate in patient safety committees or informal ad-hoc meetings to solicit regular input on medication safety issues and expand the community's awareness of the culture of safety in the organization.	34
	19) Redundancies that support a system of independent double checks or an automated verification process are used for vulnerable parts of the medication system to detect and correct serious errors before they reach patients.	**263:** The organization has an effective, interdisciplinary rapid-response team (RRT) so that any healthcare worker can summon the team to a patient's bedside for a full evaluation when established RRT activation criteria have been met and/or he or she fears that something is seriously wrong with the patient.	94
		259: Machine-readable coding (e.g., bar-coding) is used to verify drug selection prior to dispensing drugs (includes robotic dispensing).	46
	20) Proven infection control practices are followed when storing, preparing, and administering medications.	**269:** A single syringe is never used for multiple patients, even if the needle is changed in between patients.	98
		266: In the pharmacy and throughout the hospital, staff members use appropriate hand hygiene procedures and standardized aseptic technique prior to preparing any injectable product (e.g., IM, IV push, IV admixture).	77

* MAR, medication administration record; ADC, automated dispensing cabinet; ED, emergency department; dBA, decibel A scale; IM, intramuscular; IV, intravenous.

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Table 2. Collapsed Scale Used for Descriptive Analysis of Self Assessment Items

Example of an Item	Frequency of Distribution of Responses (%)				
	Original Scale Used In Assessment				
	A	B	C	D	E
Scales used to weigh patients only measure in metric units or default to metric units.	No Activity	Discussed and Considered, but Not Implemented	Partially Implemented in Some or All Areas	Fully Implemented in Some Areas	Fully Implemented Throughout
	21	18	21	14	26
	Collapsed Scale Used For Descriptive Analysis of Items				
	Not Implemented		Partially Implemented		Fully Implemented
	39		35		26

the Assessment on paper or online, which stressed the importance of establishing an interdisciplinary team to conduct the Assessment, given the complex and interdisciplinary nature of medication use, were provided. For computation of numerical scores, the completed Assessment had to be submitted to ISMP through a secure Web-based portal, which directed the hospital to an online report of its scores. The online portal required hospitals to complete all demographic and Assessment items, ensuring that only completed Assessments were accepted for analysis. A password could be used only once to submit data to ISMP.

Scoring Methods

To facilitate comparisons and the identification of opportunities for improvement, the mean percentages for each key element and core characteristic were obtained by averaging the total numerical score for each key or core from all respondents and calculating a percent score based on the maximum possible score. For example, in 2011, the maximum possible numerical score for Key Element I was 166 when combining all E answer choice values for the items within Key Element I. The mean score achieved by all respondents was 100, which resulted in a percent score of 60% when compared to the total maximum score (100/166). The range and standard deviation (SD) for each key and core were also calculated based on the percent scores achieved by respondents.

The mean percentages for each individual Assessment item were calculated on the basis of the numerical value assigned to each answer choice (A through E and Not Applicable for items with that choice option) and then were averaged on the basis of the number of responses within each of these answer choices. For example, item 199 (Table 1)—with numerical values ranging from 0 (answer choice A) to 4 (answer choice E)—attained a mean score of 3.68 among all respondents, with 4 being the maximum possible score. This score (3.68/4) represents a mean percent score of 92%. For the purpose of descriptive analysis, the frequency of distribution as a percentage was also calculated for each individual item after collapsing the 5-point scale used with the Assessment into a nominal 3-point scale[28,29] as follows: E responses represented full implementation; C and D responses represented partial implementation; and A and B responses represented no implementation (Table 2, above).

Data Analysis

Analysis of the 2011 data was conducted using the same parametric tests used with the 2000 data,[6] including means; SDs; Pearson's correlations; *t*-tests; and regression, which is commonly used when combining a series of items into composite scores.[28,30]

Linear regression models using a stepwise selection procedure were created to measure the relationship between the Assessment scores and hospital demographics and how the overall Assessment score would change when any one of several demographics varied while the other demographics were held fixed.[31] To determine if there was a statistically significant difference between two groups drawn from independent binomial samples, a one-tailed chi-square test using an alpha level of 0.05 was calculated to determine statistical significance.

Pearson's correlations were used to examine the relationship between the overall Assessment scores and core characteristic scores related to organizational culture and staff safety education. To evaluate the effect of a medication safety officer position on the scores for each key element, we calculated any variance as a percentage of difference. The Assessment items were also grouped into one of five categories based on cost and level of difficulty associated with implementation, and mean scores and SDs were calculated for composite variables within each category to assess any differences.

To compare the 2000 and 2011 study results, a two-tailed *t*-test was used to determine whether differences between the scores for each key element and core characteristic were significant. A within-subjects or repeated measures design was not pos-

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sible, given the anonymous nature of the data collected during 2000 and 2011 and the inability to use the same hospitals and team participants in both studies. Given that some hospitals participated in both the 2000 and 2011 study, a mixed-subjects design was used.

Results

Instrument Validation

The expert advisory group and professional staff at ISMP addressed the instrument's validity and assisted in clarifying the directions for use, data submission process, and interpretation of the report that was provided to participants. Overall, the Assessment instrument demonstrated good internal reliability for the 20 core characteristics (alpha = 0.89). However, the correlation among the items composing each core characteristic varied. Core characteristics related to redundancies and double checks (core 19, alpha = 0.52); drug standardization (core 7, alpha = 0.47); infection control practices (core 20, alpha = 0.44); and hazardous chemicals (core 10, alpha = 0.35) had the lowest internal reliability (see "Study Limitations"). Nevertheless, alpha exceeded 0.84 for 16 core characteristics and 0.86 for 14 core characteristics, reflecting good correlations between the items within most of the core characteristics.

Response Rate and Respondent Profile

By October 2011, 1,310 hospitals had submitted data to ISMP for a response rate of 23% of all US–registered hospitals (N = 5,786)[32]—the same response rate (1,435/6,180) for the 2000 study.[6] No respondent fatigue was identified; variability in scores at the beginning and end of the Assessment was minimal. Asking a team to complete the Assessment was intended to reduce individual respondent burden and fatigue, as well as to help ensure the accuracy of the responses. Although the range of scores for many key elements and core characteristics was large, outlier data that deviated from a normal distribution of scores or an abundance of extreme values that deviated markedly from other data in each key element and core characteristic were not observed.

Table 3 (page 58) compares the demographics of the responding hospitals in 2011 with those of the national population of hospitals. There were statistically significant differences for all demographic characteristics except setting and region. In particular, responding hospitals tended to be larger, not-for-profit, have a physician training program, be part of a larger health system, and provide more general medical/surgical services when compared to all hospitals in the United States. These same differences were observed in the 2000 study.

Aggregate Scores

The total Assessment scores in 2011 ranged from 27% to 97%, with a mean score of 71%. In 2000, the scores ranged from 26% to 85%, with a mean score of 56%[6]—representing a 27% improvement ($p < .001$) in the total mean score. Overall, in 2011 the hospitals scored better than hospitals in 2000 in all 10 key elements (Appendix 1, available in online article) and 19 of the 20 core characteristics (Appendix 2, available in online article). The scores increased significantly ($p < .001$) for all but one key element (VI) and one core characteristic (11) associated with medication devices ($p = .16$) and decreased 8% ($p < .001$) for the core characteristic (10) associated with hazardous chemicals and expiration dating of bulk chemicals used for compounding.

Key Elements with the Greatest Improvement Between 2000 and 2011

■ ***Communication of Drug Orders and Other Drug Information (III).*** Although the key element associated with communication of drug orders was one of the lowest-scoring key elements in 2000, it showed the greatest percent improvement (57.4%) between 2000 and 2011 among all key elements (Appendix 1). The scores for all comparable individual items (that is, items on both the 2000 and 2011 Assessments) related to communication of drug orders increased between 2000 and 2011.

Computerized Prescriber Order Entry (CPOE). Substantial increases were observed for implementation of CPOE—from 6% of hospitals in 2000 to 55% of hospitals in 2011, representing an 817% increase. Among hospitals that employed CPOE, 13% in 2000 versus 64% in 2011 (a 392% increase) said that the system consistently provided decision support (for example, warnings about unsafe orders) and guided safe use of formulary drugs and protocols.

Order Communication. Large improvements were observed between 2000 and 2011 associated with maintaining a list of prohibited error-prone abbreviations and dose expressions (18% to 91% [406% increase]); using and monitoring safe methods of communicating medication orders (18% to 68% [278% increase]); requiring a complete set of new orders upon admission or transfer to a different level of care in the hospital (27% to 82% [204% increase); implementing a clear and effective process for resolving conflicts surrounding the safety of an order (46% to 79% [74% increase]); having the medication administration record available at the patient's bedside during drug administration (21% to 77% [267% increase]); and not accepting verbal or telephone orders for oral or parenteral chemotherapy (50% to 75% [50% increase]).

■ ***Patient Education (IX).*** The mean score for this key ele-

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Table 3. Respondent Profile from 2011 Self Assessment Compared with a National Profile*

Demographic	Respondents (%)	National Profile (%)	Significance
Bed Size			
Fewer than 100 beds	30	51	< .001
100 to 299 beds	39	33	< .001
300 beds and over	31	16	< .001
Setting			
Rural	37	37	.46
Urban	63	63	.46
Region			
Midwest	27	28	.11
Northeast	15	14	.21
South	39	39	.42
West	20	19	.20
Ownership			
For-profit	23	21	.049
Not-for-profit	65	53	< .001
Government	11	26	< .001
Other	0.5	0	< .001
Physician Residency-Training Program			
Yes	37	19	< .001
No	63	81	< .001
Part of a Larger Health System			
Yes	72	60	< .001
No	28	40	< .001
Type of Hospital			
General medical and surgical	88	82	< .001
All others†	12	18	< .001

* Total number of hospitals in the United States and national comparisons taken from Annual Survey Database Fiscal Year 2010, Health Forum, LLC, An American Hospital Association Company, copyright 2011.

† Examples of "others" include cardiology, oncology, orthopedic, pediatric, psychiatric, rehabilitation, and women's and children's hospitals.

ment and core characteristic (16) was 48% in 2000 and 68% in 2011, representing a 42% increase ($p < .001$) and the second-highest percent improvement in a key element between 2000 and 2011 (Appendixes 1 and 2). The scores for all comparable items in this key element increased between 2000 and 2011.

Educational Focus. The largest percent increases were observed with providing customized drug administration schedules to patients at high risk for nonadherence with drug therapy on discharge (31% to 73% [136% increase]); educating patients about the importance of proper patient identification (47% to 93% [98% increase]) before drug administration; and teaching patients about the potential for errors with drugs that have been known to be problematic (59% to 81% [37% increase]). Up from 83% in 2000, 95% of the hospitals in 2011 reported that they provide patients with up-to-date written information about medications prescribed to them at discharge.

Providers of Education. In hospitals participating in 2011, more prescribers (90%) and nurses (96%) were involved in educating patients about their drug therapy than in 2000 (74% and 77%, respectively). Despite a 70% increase between 2000 and 2011, far fewer pharmacists were involved in patient education. Only 23% of hospitals in 2000 and 39% in 2011 reported that criteria have been established to trigger an automatic consultation with a pharmacist for education.

Empowering Patients. Hospitals also scored high with one new item included in the 2011 Assessment. Among the 94% of hospitals using rapid response teams, 83% empowered patients and family members to activate the team if they have unattended clinical concerns.

■ ***Quality Processes and Risk Management (X).*** The key element associated with quality and risk management processes—the largest of all key elements, comprising four core characteristics (17–20) and 63 Assessment items—demonstrated the third-largest percent improvement between 2000 and 2011 (Appendixes 1 and 2). The mean score for this key element was 51% in 2000 and 72% in 2011, representing a 41% increase ($p < .001$). The scores for all comparable items comprising this key element increased between 2000 and 2011.

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Culture. Large increases were observed with surveying practitioners periodically to assess the organization's culture (9% to 84% [833% increase]); providing leadership and peer support to all staff involved in serious errors (22% to 64% [191% increase]); including medication safety objectives in the hospital's strategic plan (38% to 82% [116% increase]); and disclosing actual medication errors to patients or families (55% to 87% [58% increase]).

Employing a medication or patient safety officer at least 20 hours a week showed significant improvement between 2000 and 2011 (12% to 40% [233% increase]). However, this item and two other comparable items related to culture (core characteristic 17) exhibited mean scores still below 50% in 2011. The other items assessed whether leaders and managers provided positive incentives for individuals to report errors (26% to 43% [65% increase]); and whether units with high reporting rates were praised for detecting and reporting risks and errors (25% to 38% [52% increase]).

Detecting, Reporting, and Analyzing Errors. The largest increase (92%) between 2000 and 2011 that related to error reporting was seen with the use of focus groups for "off-the-record" discussions to learn about risks; however, this item had a mean score of only 39% in 2011. Significant gains were also observed with using triggers or computer markers to enhance detection of potential adverse drug events (62% to 84% [36% increase]). Despite a 79% increase in scores between 2000 (29%) and 2011 (52%), almost half of the 2011 hospitals fail to convene a team to routinely analyze published error experiences from other organizations to assess vulnerability to similar errors and take proactive action to prevent errors.

Redundancies. With regard to redundant processes for the most vulnerable parts of the medication use system, the largest percent increases were seen with the use of bar-coding technology in pharmacies (10% to 53% [430% increase]) and at the point of care (3% to 58% [1,833% increase]). However, only about half (54%) of respondents in 2011 who used bar-coding technology at the point of care also consistently reviewed metrics from the system, including scanning compliance rates and bypassed or acknowledged alerts, to identify and address technology issues.

Key Elements with the Lowest Scores in 2011

■ ***Patient Information (I).*** The mean score for this key element and core characteristic (1) was 43% in 2000 and 60% in 2011, representing a 40% increase ($p < .001$) (Appendixes 1 and 2).

Technology. Only 31% of hospitals in 2000 and 46% in 2011 were successful in linking inpatient and outpatient computer order entry systems (pharmacy and CPOE systems). Just 12% of the hospitals in 2011 reported widespread use of active computer surveillance systems that monitor electronic data and notify practitioners in real time when changes may be needed in drug therapy.

Laboratory Values. Many hospitals in 2011 reported easy access to inpatient (92%) and outpatient (67%) electronic laboratory values; however, much fewer—9% in 2000 and 34% in 2011—reported that laboratory data are fully interfaced with computer order entry systems to alert practitioners to medications that may require dose adjustments or changes in drug therapy.

Patient Allergies. In 2000, 29% of hospitals required entry of patient allergies before medication orders could be entered into the computer system. Although significant improvement (51.7%) was seen in 2011, only 44% of hospitals in 2011 have made "patient allergies" a required field. Among the participating hospitals in 2011, only 43% are using computer order entry systems with a tiered severity rating for allergies to limit alert fatigue.

Patient Weights. In 2000, only 4% of computer order entry systems required the patient's weight before entering medication orders. Despite improvement (225% increase) in 2011, only 13% of hospitals in 2011 have made "patient weights" a required field. Further, just 42% of hospitals in 2011 reported that all weights and heights are measured and documented in metric units, and even fewer (26%) reported that patients are only weighed using scales that measure in or default to metric units.

Patient Monitoring. Although most hospitals in 2000 (71%) and 2011 (76%) consistently monitored patients receiving epidural or intravenous opioids, only 19% of the hospitals in 2011 consistently provided enhanced monitoring beyond pulse oximetry (for example, capnography, apnea alarms) for patients who receive opioid infusions when risk factors (for example, obesity, sleep apnea) exist.

■ ***Staff Competency and Education (VIII).*** For this key element and its two core characteristics (14, 15), the mean score was 53% in 2000 and 64% in 2011, representing a 21% increase ($p < .001$) (Appendix 1). While scores increased for all comparable items comprising this key element, opportunities for improvement abound in this second lowest scoring key element.

Orientation and Education. The majority of hospitals in 2000 (74%) and 2011 (77%) reported that all new staff undergo a baseline competency evaluation prior to working independently. However, only 30% in 2000 and 50% in 2011 felt confident that nurses and pharmacists who are pulled to work in

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new areas undergo a thorough orientation and ongoing training to maintain their skills. Similarly, special training and/or certification was required by just 44% of the hospitals in 2011 before an individual could work independently in a specialty area.

Safety Education. During orientation, only 11% of hospitals in 2000 and 39% of hospitals in 2011 provided all new clinical staff with information about the hospital's actual error experiences, published errors that have occurred in other organizations, and how to reduce the risk of such errors. On an ongoing basis, this important information was regularly shared with all clinical staff in 24% of hospitals in 2000 and 45% of hospitals in 2011. Human factors and error-reduction principles were included in the educational programs of only 27% of the hospitals in 2011. Only half (51%) of the 2011 hospitals reported that simulations of error-prone conditions are used to orient and educate staff about medication safety issues.

Pharmacists as Educators. Up from 13% in 2000, 21% of the hospitals in 2011 reported that pharmacists help orient all new medical staff to medication use and safety strategies. An increase from 17% to 22% was reported for utilizing pharmacists to provide at least four educational programs to staff per year on drug safety issues.

■ ***Drug Information (II).*** For this key element and its two core characteristics (2, 3), the mean score was 53% in 2000 and 68% in 2011, representing a 28% increase ($p < .001$) (Appendixes 1 and 2). Two comparable items scored lower in 2011 than 2000—one related to drug reference texts and the other related to formal approval of internally developed drug information resources.

Drug Information Resources. Although a majority (82%) of the 2011 hospitals maintained emergency drug dosing guidelines on code carts for adult and pediatric patients, only 32% have made equianalgesic dosing charts for oral, parenteral, and transdermal opioids easily accessible to all clinicians. For titrated drugs, only 52% of hospitals have established minimum and maximum dose limits that, when approached, require notification of the prescriber.

Medication Reconciliation. Thirty-seven percent of hospitals in 2000 and 61% in 2011 reported collecting a complete drug history for every inpatient and outpatient, accounting for a 65% increase. Almost two thirds (64%) of the hospitals in 2011 reported reconciling this list with the medications prescribed upon admission, transfer within the hospital, and discharge to identify and resolve any discrepancies.

Clinical Decision Support. Just 9% of the hospitals in 2000 and 17% of the hospitals in 2011 reported that a designated pharmacist routinely reviews reports of selected computer order entry system warnings that were overridden. Only 27% of the hospitals in 2011 periodically evaluate computer order systems for clinically insignificant and false positive alerts to address alert fatigue. Fifty-nine percent of hospitals allow practitioners to proceed with entering an order that could harm patients without acknowledging serious alerts. Only 10% in 2000 and 36% in 2011 routinely test information technology systems to verify that maximum dose alerts are functional for high-alert medications.

Clinical Pharmacy Programs. Up from 20% in 2000, 43% of hospitals in 2011 reported that pharmacists regularly work directly in inpatient care units performing clinical activities. Only 12% had pharmacists working in outpatient units such as the emergency department; yet a substantial increase (140%) was observed when compared with the 2000 data, in which just 5% reported outpatient clinical pharmacy programs.

Variables That Affected 2011 Scores

Culture and Staff Education. In 2011 the better a hospital scored on establishing a leadership-supported Just Culture (core characteristic 17), the better it scored on detecting, reporting, and analyzing errors (core characteristic 18) ($r = 0.70$, $p < .001$). Scores related to ongoing staff education about medication error prevention (core characteristic 15) also correlated with the scores for detecting, reporting, and analyzing errors ($r = 0.63$; $p < .001$). These strong correlations suggest that a supportive Just Culture and consistent staff education and feedback about medication errors and their system-based causes can facilitate improved detection and reporting of errors, analysis of adverse events, and effective use of the information to prevent errors.

Cost and Difficulty. Hospitals achieved a higher mean score (77%) for items that were classified as being the least expensive or difficult to implement (Table 4, page 61). Examples of items within this category include establishing a list of prohibited error-prone abbreviations and dose expressions (91% full implementation) and prohibiting pharmaceutical vendors and prescribers from distributing drug samples (88% full implementation). In comparison, hospitals scored a mean of 42% for items that were considered very expensive or difficult to implement. The majority of the items contained within this category involved the use of technology such as CPOE, barcode-scanning technology, and real-time computer alerts to notify practitioners of pertinent patient information.

Presence of a Medication Safety Officer. Forty percent of the hospitals that responded to the 2011 Assessment reported employing a medication safety officer at least 20 hours per week. These hospitals had higher overall scores in all key elements than hospitals without a medication safety officer, particularly for key

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Table 4. 2011 Scores Based on Difficulty and Cost Associated with Implementation of Items*

Categories Related to Cost and Difficulty with Implementing Items	Percent Scores		Weighted Scores			Number of Items in Category†
	Mean	SD	Mean	SD	Maximum Numerical Score†	
Low	77	9.6	395.9	49.3	512	104
Moderately Low	73	11.7	406.3	65.2	556	85
Moderate	67	12.4	372.7	68.7	554	64
High	60	16.8	101.5	28.5	170	17
Very High	42	24.1	39.1	22.7	94	7

* SD, standard deviation.

† If all components of a Self Assessment item with two or three distinct components, each separated with the word *or*, were grouped into the same cost/difficulty category, all components were counted as one item. If the components were grouped into different categories, each component was counted as a separate item. Thus, the numerical score and number of items in each category will not sum to 1,850 and 270, respectively.

elements associated with the provision of essential drug information (II), the organization's quality and risk management processes (X), communication of drug orders and other drug information (III), and staff competency and education (VIII).

Hospital Demographics. Hospital scores from 2011 for the 20 core characteristics were regressed on hospital size (number of beds), setting (urban versus rural), teaching affiliation, region of the country, type of ownership, whether the hospital was or was not part of a larger health system, and the type of hospital (general medical/surgical or not) using a stepwise selection procedure. These models indicated that only a small amount of the variance in scores for each core characteristic (6% on average) could be explained by the combination of these seven demographic variables.

Discussion

With a total mean score of 56%, our 2000 ISMP Medication Safety Self Assessment for Hospitals revealed a health care system that fell short of expectations to keep patients safe during medication use.[6] Since then, hospitals have undertaken an array of efforts to improve medication safety,[7–9,11,18,33–42] which is reflected in the improved 2011 total mean Assessment score. The largest improvements were observed with the methods used for communicating medication orders and other drug information, involving patients in their safety through education, and creating a culture of safety. This is not by chance, as these three areas have been highly visible on local, state, and national agendas during the last decade. We draw on a few examples among many to support our view that public policies, mobilization of interest groups, and groups working collaboratively were instrumental in our progress.

Consider, for example, improvements in the methods used for communicating medication orders and other drug information—the key element (III) with the greatest percent improvement between 2000 and 2011. Many of The Joint Commission's National Patient Safety Goals are intended to improve communication among caregivers.[20] In particular, National Patient Safety Goals related to reading back verbal orders, maintaining a list of prohibited abbreviations, and adopting a standard approach to communication during patient handoffs may have contributed largely to the improvements observed between the 2000 and 2011 scores for this key element.

CPOE provides another example. According to our Assessments, adoption of CPOE increased from 6% in 2000 to 55% in 2011 among respondents. The Centers for Medicare & Medicaid (CMS) Electronic Health Records (EHR) Incentive Programs,[43] which is part of the 2009 federal stimulus package, is likely responsible for much of the increase, particularly given the disappointing uptake of CPOE before 2009.[44] This federal program provides financial incentives for the "meaningful use" of certified EHR technology, which includes CPOE and clinical decision support to alert prescribers to unsafe orders. Incentive payments began in 2011, and by 2015, hospitals and physicians will be subject to financial penalties if not using EHRs, which should further drive CPOE adoption.

Improvements related to involving patients in their safety through education—the key element (IX) with the second-highest percent improvement between 2000 and 2011—can also be linked to numerous high-profile consumer engagement efforts. A prominent early effort is The Joint Commission's Speak Up™ campaign, initiated in 2002 in cooperation with CMS, which has been reported to increase communication about safety between patients and staff.[45] Also in 2002, the National Patient Safety Foundation launched a consumer/patient campaign, "Nothing About Me, Without Me"[46,47]—now a rallying cry of many consumer/patient advocates.[48] New Web resources, includ-

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ing ISMP's consumer/patient website ConsumerMedSafety .org,[49] AHRQ's public education campaign Questions are the Answer,[50] and CMS's Hospital Compare,[51] which provides quality data for Medicare-certified hospitals, have helped arm consumers/patients with information that invites engagement with health care providers.

Patient advocacy groups, often led by people who have suffered a personal loss related to medical errors, have also encouraged staff and patient interaction by putting a human face on patient-safety issues.[39] For example, the Josie King Foundation, formed by Sorrel King after her 18-month-old daughter died in 2001 from a medical error, led a national initiative to create rapid response systems,[52] which were strongly endorsed by safety organizations, including ISMP,[53,54] as well as the Institute for Healthcare Improvement (during its 100,000 Lives Campaign in 2005).[55] By 2011, 94% of the hospitals that completed the Self Assessment had established rapid response teams, and 83% of those had empowered patients and families to activate the system to address unresolved concerns.

Significant improvements in establishing a culture of quality and safety—the key element (X) with the third-highest percent improvement between 2000 and 2011—represent a fundamental shift in the mind-set of health care leaders that likely has had the greatest impact on patient safety. Studies have long demonstrated that an organization's culture is the most critical, underlying factor responsible for accomplishments related to safety.[56–61] It is the organization's safety culture that produces social concepts regarding attitudes and behaviors toward risk, danger, and safety.[62]

Again, public policies, mobilization of interest groups, and group collaborative efforts paved the way to this changed mindset. In 2002 AHA and ISMP responded to low safety culture scores in the 2000 Assessment by creating Pathways for Medication Safety®, a set of widely used leadership tools, which included *Leading a Strategic Planning Effort* and *Looking Collectively at Risk*.[63] AHRQ sponsored the development of patient safety culture surveys, the first released in 2004, along with tools for utilizing the results to promote culture change.[64] Support of patients, family, and staff involved in serious medical errors was bolstered by advocacy groups, including the Medically Induced Trauma Support Services[65] and the Texas Medical Institute of Technology,[66] along with compelling research[67–69] and reports[70,71] about "second victim" support systems to address the deeply personal, social, spiritual, and professional crisis often experienced by staff involved in adverse patient outcomes. By 2010 several states had successfully pioneered large-scale initiatives to adopt a Just Culture, a visionary approach to handling risk and errors that balances system and individual accountability in a manner that maximizes safety.[72] By the time ISMP launched its 2011 Assessment, a robust business case for safety, reflecting the impact of public reporting and regulatory and accreditation standards, for example, is one of the most important factors in gaining leadership commitment to improving patient safety, as Wachter argued.[39]

Hospitals made significant progress between 2000 and 2011 in regard to another hallmark of patient safety—transparency of errors.[73] Since 2001 The Joint Commission has required disclosure of "unanticipated outcomes,"[74]* which, according to Emanuel et al.,[75] is believed by some to have been the most significant influence regarding the patient's right to be informed. By 2008, 7 states had mandated disclosure of unanticipated outcomes to patients, and 36 states had enacted laws that exclude some or all information contained in a practitioner's apology from being used during a malpractice lawsuit.[76,77] National groups in the United States devoted to transparency of medical errors, including Sorry Works!,[78] emerged in the last decade, and since 2009 disclosure has been one of the National Quality Forum's Safe Practices for Better Healthcare.[79]

These and many other public policies, mobilization of interest groups, and group collaborative efforts, along with a decade of funding for patient safety research from AHRQ, have been the prime catalysts for safety improvements in health care, and their importance should not be understated, particularly as we move forward to address the opportunities for improvement revealed by our 2011 ISMP Medication Safety Self Assessment for Hospitals.

On the basis of the results of the 2011 Assessment, we have compiled a list of national priorities (Table 5, pages 63–64) that we believe require public policy directives; local, state, and national initiatives; and collaborative group efforts to inspire nationwide adoption. The priorities represent high-impact strategies that hospitals in the United States scored as low implementation.

Given the complexity and enormity of the task of making our health care systems safe for patients, harsh criticism about the lack of progress[33–38] in patient safety since the release of *To Err Is Human*[5] in 1999 is understandable. However, our study demonstrates that medication safety improvements have been substantial in the last decade, lending support to a more optimistic viewpoint that patients are clearly safer today than a decade

* Standard RI.01.02.01: "The hospital respects the patient's right to participate in decisions about his or her care, treatment, and services," Element of Performance 21: "The hospital informs the patient or surrogate decision-maker about unanticipated outcomes of care, treatment, and services that relate to sentinel events considered reviewable by The Joint Commission.

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Table 5. National Priorities for Improvement in Medication Safety*

Priority Topics	Related Self Assessment Items: Item Number	Item	Mean Score (%)	No Action Taken (%)
		Technology Enhancements		
Improve Order Entry Systems (vendor and user)	24	Patient weight is a required field before entering orders	17	70
	5	Display recent inpatient/outpatient laboratory values on order entry screens automatically for drugs requiring dose adjustments	43	34
	11	Patient allergies is a required field before entering orders	44	40
	13	Use a tiered severity rating for allergies based on patient's reaction	52	40
	8	Link inpatient and outpatient order entry systems	56	25
	43	Require an explanation when overriding serious alerts	59	32
	42	Perform dose range checks for high-alert drugs; issue dose warnings	61	26
Expand Key Technologies	6	Active computer surveillance system (real-time intervention opportunities)	35	57
	258a	End product testing of complex IV admixtures before dispensing	42	56
	61	Computerized prescriber order entry (interfaced with pharmacy computer)	45	45
	259	Barcode scanning to verify drug selection prior to dispensing	46	47
	260	Barcode scanning at the point of care	55	42
Manage Alert Fatigue	45	Periodically evaluate order entry systems for clinically insignificant/false positive alerts and take action to reduce alarm fatigue	45	45
Update/Test Technology	147	Test, review, and update smart pump drug library at least quarterly†	48	39
	148	Update smart pump drug library via wireless technology†	62	41
Use Technology Data to Improve Safety	44	Pharmacist reviews, for quality improvement purposes, reports of selected order entry system warnings that have been overridden	29	63
	146	Review data for dose and volume limits bypassed with smart pumps; use findings to reduce inappropriate bypassing or modify limits when necessary†	49	40
	261	Review metrics from point-of-care bar-coding systems (e.g., scanning rates, bypasses or acknowledged alerts); address barriers with the technology†	74	16
	145	Monitor full functionality of the drug library with smart pumps; use findings to increase compliance†	59	30
		Clinical Improvements		
Improve Care of Patients Receiving Opioids	17	Require enhanced monitoring beyond pulse oximetry (e.g., capnography) for patients receiving PCA or other IV opioids	36	51
	36	Provide equianalgesic dosing charts/dosing guidelines for opioids	52	34
Standardize Pediatric Postoperative Solutions	37	Establish standards of practice for appropriate use of pediatric postoperative IV solutions and protocols for managing hyponatremia, water intoxication, and syndrome of inappropriate antidiuretic hormone secretion†	33	55
Use Metric System Only	26	Weigh patients using scales that only measure in or default to metric units	47	39
	25	Measure and document all patients' weights and heights in metric units only	66	18
		Expanded Role for Pharmacy		
Expand Outpatient Services	50	A pharmacist works at least one 8-hour shift/24 hours in outpatient units performing clinical activities	35	57
	118	Drugs are not administered in ambulatory care areas before a pharmacist reviews the order (except urgent/lifesaving situations)	48	40
	74	Upon patient admission, tell pharmacy about all drugs administered in outpatient units (e.g., ambulatory surgery, emergency department) so they can be added to patient profile and are available when screening admission orders	55	35
	48	Enter and electronically screen ambulatory care drug orders for allergies and interactions/contraindications before drug administration (except emergencies)	56	27

(continued on page 64)

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Table 5. National Priorities for Improvement in Medication Safety (continued)

Priority Topics	Related Self Assessment Items: Item Number	Item	Mean Score (%)	No Action Taken (%)
		Expanded Role for Pharmacy (continued)		
Expand Inpatient Services	94	Pharmacy repackages doses that require less than a full tablet	42	44
	49	A pharmacist works at least one 8-hour shift/24 hours in inpatient units performing clinical activities	68	19
		Increase Patient Education		
Increase Patient Education	202	Establish criteria for automatic consultation with a pharmacist for patient education	29	61
	204	Patients informed about potential for errors with drugs known to be problematic	61	19
		Improve Staff Education		
Orient Staff	174	During orientation, pharmacists spend time in patient care units to become familiar with prescribing and administration practices	56	34
	175	Pharmacists help orient new medical staff (students, residents, attendings)	40	47
	193	Introduce human factors and the principles of error reduction during orientation and annual programs	51	36
Teach Risk Identification/ Prevention Strategies	192	Use simulations or role playing to educate staff about medication safety	38	49
	194	Leaders/managers/staff receive training in identifying risk and high-leverage error-reduction strategies	59	26
	172	Provide staff involved in medication use with information about the hospital's errors and external errors; teach staff how to reduce the risk of these errors	65	17
		Manage Risk and Safety		
Leaders Support Safety and Error Reporting	226	Practitioner employed at least 20 hours/week to oversee medication safety	46	46
	232	Trusted leaders hold focus groups to learn about problems and risks	39	50
	218	Leaders and managers provide positive incentives for reporting errors	43	46
	212	Leaders actions are consistent toward staff involved in errors regardless of the severity of patient harm	48	53
	209	Leaders don't take disciplinary action against practitioner for making a human error	64	36
Measure Medication Safety	247	Establish an effective means of measuring medication safety, which does not rely on error reports	61	22
Be Proactive	240	Interdisciplinary team analyzes and uses published errors from other organizations to proactively target improvements	71	17
	130	Team identifies error risk of new medication devices (e.g., pump) via a literature search/failure mode and effects analysis; risk addressed before purchase/use	57	29
	57	Team routinely searches the literature for reports of errors with formulary drugs; safety enhancements established as necessary	60	30

* IV, intravenous; PCA, patient-controlled analgesia.

† Scores for these items reflect only those who employ the specified technology, provide the specific service, or treat the specific population.

ago.[39–42] Yet, our task is far from completed.

Although we should take pride in the progress we have made thus far, much still remains to be done. This ongoing work depends heavily on the involvement of people and groups that excel at networking, information sharing, and persuasion.[80] These traits can be found among the successful public policy, advocacy, or collaborative groups previously described. To continue our quest for medication safety, widespread adoption will be more effective if influential groups work together, and external forces provide the necessary pressure via regulations, standards, public policy, or incentives.

Study Limitations

A number of factors could limit the generalizability and reli-

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ability of our study findings.

First, the data were self-reported and could not be independently verified. Such data may also contain potential sources of bias, including embellishment of practices when selecting a choice for each item and possible differences between hospitals that chose to participate in the study and those that did not.

Next, the Assessment response rate (23%) and the demographics of respondents may suggest a nonrepresentative sample from which inferences for all hospitals in the United States cannot be made. When calculating the response rate, the total number of hospitals in the denominator included specialty hospitals such as rehabilitation or psychiatric hospitals that were not expected to complete the Assessment because of the inapplicability of many items. Also, hospitals may have chosen not to complete the Assessment because of its length and numerous other national, state, and local quality initiatives that have consumed their attention, including those associated with CMS that affect hospital reimbursements.[81] Responding hospitals tended to be larger, be not-for-profit, have a physician training program, be part of a larger health system, and provide more medical/surgical services when compared with the population of all hospitals. However, we believe that these differences were unlikely to meaningfully affect the generalizability of the study's conclusions, given the finding that hospital demographics accounted for only a small amount of variation in scores for the 20 core characteristics. Furthermore, in a post hoc power analysis, we determined that a sample size of 1,310 hospitals would have a 97% power to detect a difference of 0.15 standard deviation (SD) in any scale between the two groups. This detectable effect of 0.15 SD is conventionally taken to be "small."[82]

A third possible study limitation entails the direct comparability of the 2000 and 2011 Assessment scores. Although 57% of the 2011 participating hospitals also reported completing the 2000 and/or 2004 Assessment, we were unable to verify actual data submission of these hospitals or exactly match the 2000 and 2011 participating hospitals, given anonymous data submission. We were also unable to verify that the same team members conducted the Assessment in 2000 and 2011. Thus, we could not segregate this data set for a within-subjects study design. In addition, new items were added to the 2011 Assessment, and minor wording changes were made to several existing items between the study periods. The number of items increased from 194 in 2000 to 270 in 2011. However, the key elements and core characteristics—and the key practices and processes addressed within them—did not change, and the items that comprised these larger categories of safe medication use are what ISMP and the expert advisory panels in 2000 and 2011 considered best practices for their respected time frames. Thus, comparisons between the 2000 and 2011 key elements and core characteristics are representative of improvements or setbacks in implementing the best practices available during their respected time frames.

The final possible study limitation is related to the survey instrument. Although the survey's overall internal reliability was very strong, items within four core characteristics did not appear to relate well to one another, perhaps reflecting the small number of items within these core characteristics; a low value of alpha could be due to a low number of questions.[83] However, the low internal reliability coefficients for these four core characteristics do not affect the results as presented in this article. Much of the descriptive analysis occurred at the key element and individual item level, and both the key element scores and the overall Assessment score are based on the individual items—not on the core characteristics in which the items were subgrouped. J

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Online-Only Content

See the online version of this article for
Appendix 1. Comparison of 2000 and 2011 Key Element Scores
Appendix 2. Comparison of 2000 and 2011 Core Characteristics

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Appendix 1. Comparison of 2000 and 2011 Key Element Scores*

	2000 Scores			2011 Scores			Comparison Between 2000 and 2011 Scores†‡			
Key Element	Mean (%)	SD (%)	Range (%)	Mean (%)	SD (%)	Range (%)	Change (%)	*t*	df	Significance (2-tailed)
I. Patient Information	43	11.39	10.00–88.00	60	15.11	12.05–98.19	39.5 increase	-34.0	2706	< .001
II. Drug Information	53	14.62	4.61–100.00	68	15.06	11.31–100.00	28.3 increase	-25.5	2682	< .001
III. Communication of Drug Orders and Other Drug Information	47	13.88	9.78–94.57	74	14.88	19.30–100.00	57.4 increase	-48.8	2636	< .001
IV. Drug Labeling, Packaging, and Nomenclature	61	15.39	15.00–98.75	74	12.07	17.39–100.00	21.3 increase	-25.0	2698	< .001
V. Drug Standardization, Storage, and Distribution	73	12.09	29.69–98.96	81	10.38	27.01–100.00	11.0 increase	-17.9	2653	< .001
VI. Medication Device Acquisition, Use, and Monitoring	69	17.48	0.00–100.00	70	17.88	2.86–100.00	1.4 increase	-1.4	2677	.16
VII. Environmental Factors, Workflow, and Staffing Patterns	70	15.76	21.74–100.00	77	14.80	26.09–100.00	10.0 increase	12.6	2702	< .001
VIII. Staff Competency and Education	53	16.01	9.26–100.00	64	16.17	13.58–100.00	20.8 increase	-16.9	2705	< .001
IX. Patient Education	48	17.55	0.00–100.00	68	16.18	5.71–100.00	41.7 increase	-30.8	2730	< .001
X. Quality Processes and Risk Management	51	13.51	12.67–95.00	72	13.96	18.09–99.59	41.2 increase	-39.5	2557	< .001
Total Self Assessment	56	10.10	25.56–84.67	71	10.87	26.54–96.76	26.8 increase	-40.3	2743	< .001

* SD, standard deviation; df, degrees of freedom.
† Equal variances assumed with *t*-test.
‡ All confidence intervals are 95% at an α level of .05.

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Appendix 2. Comparison of 2000 and 2011 Core Characteristics *

Core Characteristic	2000 Scores			2011 Scores			Comparison Between 2000 and 2011 Scores†‡			
	Mean (%)	SD (%)	Range (%)	Mean (%)	SD (%)	Range (%)	Change (%)	*t*	df	Significance (2-tailed)
I. Patient Information										
1. Essential patient information obtained, readily available, and considered	43	11.39	10.00–88.00	60	15.11	12.05–98.19	39.5 increase	-34.0	2706	< .001
II. Drug Information										
2. Essential drug information readily available and considered.	52	14.65	3.70–100.00	66	14.88	14.49–100.00	26.9 increase	-24.9	2695	< .001
3. Controlled drug formulary system	56	22.70	0.00–100.00	72	21.66	0.00–100.00	28.6 increase	-18.4	2730	< .001
III. Communication of Drug Orders and Other Drug Information										
4. Streamlined, standardized, and automated methods of communicating	47	13.88	9.78–94.57	74	14.88	19.30–100.00	57.4 increase	-48.8	2636	< .001
IV. Drug Labeling, Packaging, and Nomenclature										
5. Strategies to minimize errors with look- and/or sound-alike drugs	48	21.52	0.00–100.00	71	15.55	7.69–100.00	47.9 increase	-31.3	2723	< .001
6. Readable labels on all drug containers	74	15.35	20.00–100.00	79	12.63	10.00–100.00	6.8 increase	-9.3	2711	< .001
V. Drug Standardization, Storage, and Distribution										
7. Standardized IV solutions, drug concentrations, doses, and administration times	71	16.78	10.71–100.00	88	12.28	0.00–100.00	23.9 increase	-31.4	2729	< .001
8. Safe, secure, and timely delivery of medications to patient care units	70	20.00	6.82–100.00	81	14.47	22.22–100.00	15.7 increase	-15.7	2719	< .001
9. Restricted unit stock	73	14.43	8.33–100.00	79	12.24	21.21–100.00	8.2 increase	-12.8	2696	< .001
10. Hazardous chemicals safely sequestered	86	14.88	12.50–100.00	79	25.23	0.00–100.00	8.1 decrease	7.7	2717	< .001
VI. Medication Device Acquisition, Use, and Monitoring										
11. Careful procurement, maintenance, use, and standardization of devices	69	17.48	0.00–100.00	70	17.88	2.86–100.00	1.4 increase	-1.4	2677	.16

(continued on page AP3)

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Appendix 2. Comparison of 2000 and 2011 Core Characteristics (continued)

Core Characteristic	2000 Scores Mean (%)	2000 Scores SD (%)	2000 Scores Range (%)	2011 Scores Mean (%)	2011 Scores SD (%)	2011 Scores Range (%)	Comparison Between 2000 and 2011 Scores†‡ Change (%)	*t*	df	Significance (2-tailed)
VII. Environmental Factors, Workflow, and Staffing Patterns										
12. Efficient and safe workflow in a distraction-free environment with adequate space and lighting	69	18.26	4.55–100.00	74	17.43	14.81–100.00	7.2 increase	-7.6	2726	< .001
13. Complement of qualified, well-rested practitioners matches the workload	71	18.41	8.33–100.00	80	16.57	9.52–100.00	12.7 increase	-12.4	2718	< .001
VIII. Staff Competency and Education										
14. Sufficient orientation and baseline and annual competency evaluations	56	16.03	5.88–100.00	67	15.09	19.57–100.00	19.6 increase	-18.9	2717	< .001
15. Ongoing education about medication error prevention and safe use of drugs	49	21.78	0.00–100.00	59	21.78	0.00–100.00	20.4 increase	-12.1	2729	< .001
IX. Patient Education										
16. Patients included as active partners through education	48	17.55	0.00–100.00	68	16.18	5.71–100.00	41.7 increase	-30.8	2730	< .001
X. Quality Processes and Risk Management										
17. Safety-supportive Just Culture and shared accountability model	46	17.45	3.57–100.00	71	17.53	6.57–100.00	54.3 increase	-38.1	2701	< .001
18. Practitioners detect and report adverse events, errors, and hazards, and teams analyze the reports	55	21.47	0.00–100.00	73	18.16	0.00–100.00	32.7 increase	-23.0	2688	< .001
19. Redundancies that support a system of independent double checks or automated process used	41	16.96	0.00–100.00	68	16.58	4.63–100.00	65.9 increase	-41.9	2643	< .001
20. Proven infection control practices followed	83	14.07	0.00–100.00	87	14.05	10.71–100.00	4.8 increase	-7.5	2715	< .001
Total Self Assessment	56	10.10	25.56–84.67	71	10.87	26.54–96.76	26.8 increase	-40.3	2743	< .001

* SD, standard deviation; df, degrees of freedom.
† Equal variances assumed with *t*-test.
‡ All confidence intervals are 95% at an α level of .05.

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