The Environmental Context of Patient Safety and Medical Errors

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ABSTRACT: *The environmental context of patient safety and medical errors was explored with specific interest in rural settings. Special attention was paid to unique features of rural health care organizations and their environment that relate to the patient safety issue and medical errors (including the distribution of patients, types of adverse events associated with learning, information flows, triage and transfer decisions, and culture of safety). Relevant organizational theories and strategies for medical error reduction and prevention in rural health care settings were identified. Financial and technical assistance are needed to support the systematic collection of data from rural hospitals and other entities and to enhance relevant patient safety practices for rural America.*

Interest in the issue of patient safety and medical errors has accelerated over the last decade,[1-3] most recently culminating in widespread media attention and policy consideration at the state and national levels of government, by accrediting bodies, by health care organizations, and by employer groups. The report by the Institute of Medicine (IOM), *To Err Is Human,* has been widely acknowledged as the catalyst for recent national attention to and proposed action on these issues.[4] *Doing What Counts for Patient Safety: Federal Actions to Reduce Medical Errors and Their Impact* by the Quality Interagency Coordinating Task Force[5] and IOM's *Crossing the Quality Chasm*[6] further expanded the issue. Three themes that run through the reports are

- a systems framework for the patient safety/medical error issue
- the interdependence of people, technology, and organizations within that framework
- the central role in error reduction of effective, accessible, and "remembered" communication about each individual patient

The applicability of these themes will differ between rural and urban health care settings. To our knowledge, only 1 publication has explored the implications of the IOM reports for rural health systems.[7] Here, we extend this work by using organizational theory and interviews with hospital administrators to explore patient safety and medical errors in rural settings (Note 1). We used organizational theory to identify the features of rural health care organizations and their environment that relate to patient safety and medical errors, and we explored strategies suggested by organizational theory for preventing and reducing medical errors in rural health care settings.

Rural Hospitals, Patient Safety, and Medical Errors

There is little information available to allow evaluation of how patient safety and quality of care differ between rural and urban settings. To our knowledge, the only estimate of incidence or errors in patient outcomes in rural areas is an adverse event (AE) rate (percentage of patients discharged who had experienced an AE due to hospitalization) of 1% in rural hospitals in New York State in 1984.[8] This rate was significantly lower than for metropolitan institutions;

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however, the rate of AEs due to negligence did not vary between metropolitan and rural hospitals. Similarly, little is known about differences in hospital safety organization between urban and rural settings.

Differences in types and rates of errors between rural and urban settings would be expected because of the challenges facing rural hospitals, which include[9] (1) less diversity and fewer providers and staff; (2) less diverse range of services across the full continuum of care; (3) fewer financial resources (partly because of size and partly because of differences in rural/urban reimbursement from government programs); (4) lower patient volume; (5) bypass of rural providers by rural patients; (6) lack of a system for sharing of resources to address quality issues or benchmark outcomes; (7) distance and geographic barriers; (8) limited automated information system support for both clinical work and quality measurement; and (9) perceived inappropriateness of accreditation standards for rural hospitals. Although urban hospitals also encounter many of these challenges, strategies for addressing the challenges are likely to differ between urban and rural hospitals.

These challenges can be categorized by how they are resolved. Constraints are challenges resolved by policy changes, often having a long time frame. Managerial problems are challenges resolved by hospital managers and staff in the short term, taking constraints as a given. Examples of constraints are nurse supply, which affects errors through its effect on nurse staffing ratios,[10] and resource availability, which affects errors through its effect on the ability of a hospital to install tools such as electronic medical records and to hire more staff. Constraints must be dealt with in the larger policy environment, such as nurse training and rural hospital payment policies. Systematic difference in types of managerial problems between rural and urban hospitals suggests that hospital managers must focus their attention differently to create safer organizations. We have developed hypotheses about these differences.

We modeled the rural hospital as a system that adapts to fit its context. Systems are "a set of interdependent elements interacting to achieve a common aim. The elements may be both human and non-human (e.g. equipment, technologies)."[4(p52)] A hospital consists of a variety of subsystems such as pharmacy, surgery, medical care, admissions, billing, laboratory, and medical records. Rural hospital system complexity is a function of organizational size, technological complexity, and environmental complexity. Differences in size, technology, and environment result in rural/urban differences in processes, information flows, safety culture, and organizational learning to improve safety.

Here, we have characterized hospital systems as processes, networks of information flows linking routines.[11–13] Information flows are broadly characterized as those between (1) the patient and the system; (2) the current evidentiary knowledge base and health care practitioners; (3) the components within the health care organization; and (4) the organization and other organizations. Routines are what is done in a hospital: a patient being admitted, an RN administering medications, a surgeon performing an operation, and a patient's condition being monitored. These routines are supported by information systems that store and retrieve information, such as maintaining a record of patient medications that can be accessed to check for drug interactions when a new drug is prescribed. We also evaluated rural-urban differences in hospital processes, information flows, the culture of safety, and organizational learning.

Distribution of Patients and Errors

Patient mix is the first major contextual difference. Rural areas are more likely to have a preponderance of elderly patients, which is associated with rural hospitals being more likely to have swing beds and closely affiliated nursing homes.[14] Thus, rural hospitals will be disproportionately faced with medical injuries and adverse drug events associated with these populations.[15,16] Because of their large elderly populations, rural hospitals are disproportionately at risk for problems such as hospital-acquired complications and falls.[17]

Hypothesis 1. Rural hospitals will have a greater proportion of AEs associated with the elderly than will urban hospitals.

Volume, Uncertainty, and Under- and Overlearning

Rural and urban hospitals differ in types of AEs associated with learning. In an urban hospital with a refined division of labor, a provider performs a specific activity repeatedly. Although this repetition can lead to greater expertise, it can also lead to complacency. In a rural hospital, procedures are more likely to be performed so infrequently that providers are concerned about whether they are doing the procedure correctly. The mixing of IV solutions provides an example. In an urban hospital, an IV is likely to be done as a standard routine by a pharmacy technician. A small deviation from the usual (eg, different units of measure when dealing with a small child) can be missed, and an error may be made. In a rural hospital, registered nurses may need to mix the IV solutions when there are no

personnel in the pharmacy (eg, at night and on weekends). Similarly, physicians in rural hospitals see a more diverse group of patients. Nonetheless, the rural physician may face the dilemma of whether or not to treat a low-volume condition or risk patient death during transport to an urban hospital. These different types of potential AEs must be addressed with different managerial strategies. Underlearning and inexperience is addressed with training,[17] and overlearning is addressed with attention-forcing mechanisms.

Hypothesis 2. Rural hospitals will have a smaller proportion of AEs associated with overlearning than will urban hospitals and a greater proportion of AEs associated with underlearning (lack of expertise due to low condition-specific volume).

Information Flows: Patient to Hospital

A common observation from rural hospital administrators and staff concerns the relationship of hospital staff to community members. Staff often know patients both as patients and as community members. Staff and patients live in the same neighborhood, attend the same church, or shop at the same stores. This phenomenon, which sociologists call social embeddedness, affects information flow between patients and the hospital. In a rural hospital, the physician who treats a local resident for an emergency condition on Friday night may see the patient the next week at the local store and ask them about their condition. A physician treating a patient for a chronic condition interacts with other individuals in the patient's social support network.

Embeddedness has its pluses and minuses. The staff's history with the patient may make it easier to spot an anomalous result, such as a lab technician noting an untoward change in a lab reading and calling it to a physician's attention. The shared information between patient and staff may support a richer base of information for diagnosis and treatment, avoiding some errors. However, embeddedness and its associated informality may lead to complacency, such as armbands not being checked when hospital staff know the patient, information not being communicated because staff members assume that other staff members know about the individual, or information being discounted when it does not fit stereotypical beliefs about the patient. Although urban hospitals face managerial problems associated with not gathering enough information, rural hospitals may face problems associated with a culture of complacency and assumed knowledge, which may cause staff to overlook or discount near misses. This type of complacency may need to be countered by developing a culture of safety that seeks to minimize overconfidence.[18]

Hypothesis 3. Rural hospitals will have a smaller proportion of AEs associated with information flows between the patient and the hospital than will urban hospitals and a greater proportion of AEs associated with assumed shared knowledge about patients.

Information Flows Between Organizations: Triage and Transfer

Rural hospitals generally treat a more limited variety of conditions than do urban hospitals. Although urban and rural hospitals of similar size may treat similar conditions, the context differs dramatically. In an urban setting, patients are more readily routed to the appropriate hospital during initial transportation, and the distance a transferred patient must travel to another facility is relatively low. The greater distances patients from rural hospitals must travel may increase the chances of AEs during transport, and this potential must be addressed with specialized transport teams and greater coordination between the rural hospital and the transfer team.[17] The distances involved also make the decision to immediately triage and transfer a patient, stabilize and transfer a patient, or treat the patient significantly different in a rural setting than in an urban setting. The following example of emergency care treatment of acute myocardial infarction illustrates the different types of challenges physicians face depending on the availability of human and infrastructure resources (the example was provided by Dr A. Clinton MacKinney, formerly a rural family physician and currently consulting with Stroudwater Associates, Portland, Maine).

For the urban physician treating an acute myocardial infarction, the resources of an urban medical center allow straightforward clinical decision making. Standard protocols for chest pain (ie, monitoring, ECG, lab results, oxygen, nitroglycerin, morphine) are provided by an emergency room (ER) team shortly after patient arrival and without physician input. The urban physician's clinical decision making includes

1. confirm a pertinent history
2. perform a pertinent exam
3. confirm patient stability
4. review the ECG computer-generated diagnosis of acute myocardial infarction
5. ensure proper interventions have been provided
6. ask staff to notify the on-call cardiologist immediately

At this point, the urban physician's clinical decision making is complete.

In contrast, for a rural physician treating an acute myocardial infarction, supporting human and infrastructure resources are comparatively limited. The rural physician's clinical decision making may include

1. assess the nursing history telephoned in the middle of the night
2. recall from memory medication dosages and specific interventions for chest pain patients
3. obtain a pertinent history
4. perform a pertinent exam
5. review the ECG and diagnose acute myocardial infarction
6. recall that ST segment elevation in lead V1-4 is more likely to be complicated by congestive heart failure
7. asess the patient for clot-busting medication appropriateness (there is no pharmacy protocol developed)
8. read the package insert for the new clot-busting medication (the physician has never used this product before)
9. after reading the insert, obtain further history and testing to ensure that the patient does not develop life-threatening complications from the medication
10. assess nursing capability to properly mix and infuse the medication
11. recall that other interventions are now needed such as aspirin and beta blockers (there is no hospital protocol for these interventions and medication dosages must be looked up)
12. observe reperfusion arrhythmias and wonder if treatment is needed
13. discuss transfer with patient and family
14. assess weather conditions for helicopter transfer
15. personally telephone urban ER and discuss transfer with ER physician and cardiologist
16. recall and write up paperwork necessary for patient transfer to avoid Emergency Medical Treatment and Active Labor Act (EMTALA) violations
17. provide a clinical update via radio to the helicopter crew
18. reassess patient and note clinical deterioration with shortness of breath
19. note that a chest radiograph was never completed
20. order and review a chest radiograph with limited experience to note subtle pulmonary edema
21. nonetheless, diagnose congestive heart failure and recall latest treatment protocol
22. hope the patient does not arrest before the helicopter arrives because advanced cardiac life support training was completed years ago and no one is trained in intubation
23. respond to a precipitous delivery in obstetrics during this ER cardiac case

Making the triage and transfer decision more difficult is the mixed evidence for patient outcomes, some of which indicates that stabilization before transfer does not increase mortality[19,20] and some of which indicates that direct transport of trauma patients reduces mortality.[21] Research suggests that it may be possible to develop guidelines that can assist in the triage-and-transfer decision,[22] but the differences between urban and rural hospitals in decision making suggest that these protocols will differ between the two settings. The decision making problem also varies as a function of whether the hospital has a statewide[23] or other geographically based[24] triage-and-transfer system available. Development of these geographically based systems may support the creation of specialized teams to transfer patients and may standardize communication channels between organizations; both improvements could reduce the risks and difficulties associated with triage-and-transfer decisions.[17]

Hypothesis 4. Rural hospitals will have a greater proportion of AEs associated with triage-and-transfer decisions and a greater proportion of AEs associated with transporting patients than will urban hospitals.

Developing a Culture of Safety

The IOM calls on health care organizations to "develop a culture of safety such that an organization's care processes and workforce are focused on improving the reliability and safety of care for patients."[4(p14)] Development of a culture of safety is likely to differ significantly between rural and urban hospitals.

Culture is a set of shared beliefs among organizational members that define behavior as moral (appropriate).[25,26] A culture of safety is present when employees believe that the behaviors to support reliability and safety are as or more important than behaviors to improve productivity.[27] In a culture of safety, employees believe it is appropriate to report errors, believe they will be treated fairly, are flexible in work roles so they can manage unexpected errors, and can learn from experience.[18,28] A culture of safety is created and supported through recruiting, training, socialization, incentives, processes (eg, blame-free reporting), and leadership.[17,29]

The context of the safety culture is likely to differ between rural and urban hospitals. Culture has 2 basic sources: interaction based on a common situation and interaction based on a division of labor.[25,30] The former results from people developing shared beliefs because of their regular interactions in a common context, as occurs

in rural hospitals because of their small size and their embeddedness in the community. In urban hospitals, the larger size, greater specialization within professional roles, and more diverse patient base make regular interaction more difficult. In a large urban hospital, the division of labor may result in distinct subcultures within organization units. In these larger urban hospitals, culture is more likely to be based on the division of labor.

These differences in the source of culture have implications for the culture of safety within rural hospitals. In a rural environment, management must encourage a culture that does not take the system for granted, does not discount unexpected events, and questions the fallibility of the system. Employees may be reluctant to question the existing hospital system because of their common ownership. As a result, the system's fallibilities may be overlooked, and unexpected errors may be discounted because they do not fit into the stereotype (there may be many idiosyncratic reasons to discount an error with a known patient). Because everyone knows everyone else, it may be difficult to guarantee anonymous reporting, which is critical to safety management.[29] In contrast, in an urban hospital management must focus on integrating the subcultures of different professions and units. The greater complexity in an urban hospital may lend itself to an anonymous reporting system.

Hypothesis 5. Rural hospitals will find it easier than urban hospitals to build a culture of safety based on a feeling of being in a community but will find it more difficult to build tools such as anonymous reporting systems.

An Organizational Patient Safety Learning Model for Rural Hospitals

Organizations improve safety through learning, the implementation of incentives, rules, structures, and processes that provide safer health care. Tools to manage safety can be placed along a local-global continuum. Local tools are those that are unique to a particular rural hospital, such as a home-grown information system or training program. Global tools are those that look the same in every hospital, such as standardized operating room environments for anesthesiology[4] and statewide trauma transfer systems.[23]

A significant managerial problem is making the decision when to invest in improving safety by exploiting a hospital's own local capabilities or by exploring new capabilities by acquiring new global technologies and processes. Rural hospital administrators infrequently have the luxury of aggressively pursuing both strategies because of limited budgets and resources. Although some have argued that, for example, computerized physician order entry for drug prescriptions should be widespread, the feasibility of its implementation is difficult because "physician order entry is a major process change; its implementation can be difficult and expensive. An organization wishing to realize its benefits must not only choose a well-designed system, but must also consider pre-implementation management and education and post-implementation technical and functional support."[31(p2746)]

How can organizational learning to improve patient safety be facilitated in rural hospitals? This question broadly separates into 2 questions:[32]

1. When and how should rural hospitals explore global technologies and processes by adopting them?
2. When and how should rural hospitals exploit their existing local technology and processes by refining them?

Exploration and exploitation are fundamentally different strategies for reducing errors and are difficult to trade off. Exploration is risky, especially with new technologies, because it may require large investments in equipment and in training with uncertain prospects about the magnitude of the benefit. Exploitation can result in the organization falling into a competency trap, which occurs "when favorable performance with an inferior procedure leads an organization to accumulate more experience with it, thus keeping experience with a superior product inadequate to make it rewarding to use."[33(p322)] Because of limited resources, organizations trade off these two learning strategies.

Balancing the trade-off between exploration and exploitation varies as a function of the learning context.[33] Learning contexts vary along 3 dimensions: ambiguity, technological uncertainty, and performance measurement. Examples of types of interventions used to reduce medical errors in each type of organizational learning context are provided in the Table.

Ambiguity describes the understanding of the causal processes driving the desired outcomes. In an unambiguous process, the technology is well understood. The effect of changing an aspect of the process on patient outcomes is well known. In ambiguous processes, the effect of changing an element of the process on outcomes is unclear. An example is drug interaction effects, where the effect of a drug is conditional on an individual's genetic structure. In general, as complexity and interdependence increase, ambiguity increases and determination of cause-effect relationships becomes more difficult. The solution to ambiguity is improving the understanding of causal relationships.

Learning Context for Patient Safety by Type of Intervention to Reduce Medical Errors

Organizational Problem Type	System Design Issue to Be Addressed	Type of Intervention: Exploitation (Develop and Improve Internal Capabilities)	Type of Intervention: Exploration (Adopt Technologies External to Organization)
Ambiguity	Understand types of error	Collect incident reports: conduct face-to-face confidential interviews with front-line practitioners; conduct safety walk-throughs of units/departments	Familiarity with scientific and other literature; direct and indirect forms of information sharing between organizations; participation in collaborative studies
	Understand causes of performance and error	Apply continuous quality improvement and plan-do-study-act cycles to errors to better understand causes of performance Perform root cause analysis	Familiarity with scientific and other literature (eg, sentinel events); direct and indirect forms of information sharing between organizations; participation in collaborative studies
	Create a culture of safety	Encourage reporting of errors and hazardous conditions; ensure no reprisal for reporting; develop a working culture in which communication flows freely regardless of authority gradient; implement mechanisms of feedback and learning from error; focus on operations and resiliency	
Technological uncertainty	Avoid/reduce reliance on memory	Point-of-care reminders: clinical best practice guidelines; physician order sheets; pre- and postoperative checklists; drug formulary; allergy wristbands; order-writing standards; brand-generic drug name charts; equipment safe operation guides	Computerized corollary order support; computerized physician order entry and clinical decision support systems
		Accessible up-to-date printed drug information	Computerized drug information databases (eg, Micromedex or hand-held devices)
	Standardize processes	Create clear guidelines and standards for writing medication orders Standardize medication administration times to reduce the chance of omissions	Computerized physician order entry system
	Standardize (and check) equipment	Standard placement and identification of medications in units and in drug carts	Use of robotics and automation in medication dispensing

Continued

Organizational Problem Type	System Design Issue to Be Addressed	Type of Intervention: Exploitation (Develop and Improve Internal Capabilities)	Type of Intervention: Exploration (Adopt Technologies External to Organization)
	Use double checks at critical stages in processes	Use "hearback" for oral orders and instructions Pharmacy software with up-to-date drug interaction capability	
	Match expertise with task and/or patient demands	Clear organizational definitions, indicators, and procedures for matching staff mix and numbers with task/patient demands	
	Eliminate or reduce impact of loss of expertise due to gaps in coverage	Clear policies, protocols and training for off-hours access to pharmacy Clear policies, protocols, and training for preparation and dispensing of high-hazard medications in absence of pharmacist	Provide around-the-clock radiology, pharmacy, and laboratory services or access to expertise via video conferencing
	Improve interdisciplinary communication and teamwork	Involve broad range of health professionals on patient safety committee	Offer team training to those who are expected to work in teams (eg, critical care areas) using crew resource management techniques from aviation
	Design for recovery	Keep antidotes for high-risk drugs up to date and easily accessible Standardize procedures for responding quickly to adverse events	
Performance measurement	Track error occurrence and types	Compile and analyze incident reports (or chart review or administrative data) within an organization and benchmark over time Develop written policies and procedures that include competency standards for each patient care area and a method for measuring individual performance against those standards	Use tracking system developed by external entity who will benchmark in-house data with those of similar institutions

Technological uncertainty is associated with determining whether the system actually is doing what it is designed to do. Uncertainty also may be caused by slips or lapses in the use of a technology. Incorrect values may be entered while doing a laboratory test, resulting in an erroneous laboratory reading. An incorrect drug may be dispensed. System design affects these slips and lapses.[34,35] Turbulence causes uncertainty about what the system is supposed to do (eg, due to new government regulations such as those from the Health Insurance Portability and Accountability Act [HIPAA], or the advance of new

technologies such as personal computers and the Internet). Although the system does not change, the technological frontier for the system and performance expectations about it lead to uncertainty about the existing system's capability. Uncertainty also may be caused by difficulties in implementing a new system. Adopting new technologies, a form of learning by exploration, often requires significant investments in new machinery, in skilled individuals who can operate the new machinery, in training of existing personnel, and in restructuring organizations. For example, the adoption of diagnostic imaging using computed tomography and magnetic resonance imagery resulted in significant changes within organizations, particularly in occupational arrangements.[35-37] Slips and lapses are likely to increase during these learning processes.

Performance measurement is used to assess performance and to guide learning, such as by comparing current performance to targets generated as guides to future performance improvement. Error reduction depends on the measurement of errors and near misses to determine the frequency and source of errors.[38] Measurement accuracy varies as a function of the frequency with which an event occurs. In rural hospitals, measurement problems may be caused by the low frequency of many events. In cases where events are rare, such as overdoses that have occurred with chemotherapy,[39] or the frequency is low, organizations are often forced to learn from single events.[40]

Perhaps the easiest learning context involves low system ambiguity and certain technologies with sufficient countable events so that errors can be monitored. In this situation, rural hospitals can use standard quality improvement techniques (eg, root cause analysis) to monitor error rates and reduce them. Thus, the first strategy for rural hospital learning about errors is to decrease system ambiguity, formalize technologies to decrease uncertainty, and identify countable events that can be monitored. Ambiguity reduction strategies include standard systems analysis techniques.[41] Systems analysis can identify countable events, such as slips, that can be used for monitoring and reducing error rates. One difficulty in implementing this approach is that rural hospitals may not have the resources required to support the administrative staff specialized in system and task analysis. However, the small scale and lower complexity of rural hospitals may make the analysis relatively simple. Externally based facilitators or programs to support training of staff in these techniques may be useful.

Very difficult situations are rare events where the technology is ambiguous and uncertain. Rural hospitals may have an advantage in this situation because it is easier to maintain rich, specific descriptions associated with the event, which is useful in understanding the cause of errors.[42] The rural hospital has an advantage because maintaining and analyzing rich contextual information in large-scale systems is burdensome and difficult. Even if information is maintained, analysis is difficult because analysts lack the contextual understanding of the system's nuances. The smaller size, lower complexity, and informal relationships among individuals in the rural hospital mean that maintaining and analyzing rich contextual information is less costly and more easily done.

Rural hospitals may benefit especially from benchmarking across similar rural hospitals. Organizational goals are set in a comparative process, comparing their own performance over time or comparing the performance of similar organizations at the same time.[43] Continuous quality improvement strategies rely on the former approach.[44] However, comparing performance within the organization over time can result in a competency trap, where an organization continually improves a suboptimal process. Benchmarking supports exploration of the problem and helps the rural hospital identify competency traps.

Thus, a second strategy for helping rural hospitals to manage the error-learning process is to develop common measures across rural hospitals that allow them to determine whether they are falling into a competency trap. Common measures could be developed by using anonymous reporting tools that encourage house staff and physicians to provide rich anecdotal information on near misses and errors to a trusted third party. These types of reporting mechanisms capture a richer set of data at a lower cost than do procedures such as coding medical records.[45-47] The third party could code measures that are comparative within and/or between hospitals[48] and could support regular physician and house staff review meetings to better focus error prevention and safety efforts within each rural hospital.[49]

Conclusion

The central organizational goal in adopting a specific patient safety practice is to achieve a fit between the problem and proposed solution; this fit can only be ultimately realized within the unique context of each organization. Of course, in finding a fit an organization is well-advised to also look outside itself, especially to organizations operating in similar environments and offering a similar range of services; there will be some degree of convergence in problems and solutions between such organizations. There is risk, however, in adopting a patient safety practice simply

because it works somewhere else. Doing so without first verifying the existence of a particular problem and identifying its real or potential causes within a particular organization is likely to breed a "solution" that exists on paper only or, even if successfully adopted and running smoothly, accomplishes little more than a false sense of security within the organization.

The strength of evidence for various patient safety practices has only recently begun to be evaluated.[17,50] We currently know little about patient safety and medical errors in the rural context. Here, we have addressed only a selection of rural patient safety issues and have not included safety issues such as infection control and intensive care units, which have been identified as priority areas.[51] However, the arguments presented here should be extendable to these other areas.

The time to learn about patient safety, medical errors, and successful interventions in rural hospitals and environments is now. The reduced scale and complexity of rural institutions can provide an excellent laboratory for examining patient safety and medical errors issues. An important next step is financial and technical support for the systematic collection of data from rural hospitals and other entities that will lead to relevant patient safety practices for rural America.

Notes

1. The interviews were conducted at 2 rural hospitals, Mercy Hospital and Health Care Center, Moose Lake, Minn., and Myrtle Werth Hospital, Menomonie, Wis. The authors were the interview team. The chief executive officer and representatives of most major hospital units were interviewed (eg, medical and nursing directors, laboratory manager, safety/quality director) using a structured interview that focused on safety and error management. The team summarized each interview. Organization theory and a literature review on safety was used to guide the development of the structured interview.

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