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The importance of hospitals learning from their failures hardly needs to be stated. Not only are matters of life and death at stake on a daily basis, but also an increasing number of U.S. hospitals are operating in the red.[1] Organizational learning is thus an imperative. Recent research suggests there are plenty of problems, errors, and other learning opportunities facing these complex service organizations. In 2000, the Institute of Medicine issued a report estimating that 44,000 to 98,000 people die each year as a result of medical errors.[2] Other studies suggest, in addition, that medical errors with less serious consequences are pervasive in hospitals.[3]

Hospitals historically have relied on a dedicated and highly skilled professional workforce to compensate for any operational failures that might occur during the patient care delivery process. Great doctors and nurses, not great organization or management, have been seen as the means for ensuring that patients receive quality care. Recently, however, the medical community has responded to increased public awareness of shortcomings in health care delivery by calling for systematic, organizational improvements to increase patient safety. Examples of such initiatives include creating shared databases of medical errors to facilitate widespread learning from mistakes and focusing renewed attention on hospital processes, culture, and reporting systems.[4]

Front-line employees in service organizations are well positioned in these efforts to help their organizations learn, that is, to improve organizational

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outcomes by suggesting changes in processes and activities based on their knowledge of what is and is not working.[5] Identifying and resolving causes of problems that arise during the course of work is one method for achieving organizational learning. By catching, correcting, and removing underlying causes, front-line employees can contribute to changes that help avoid erosion of quality and customer satisfaction in the future. In this way, through initiative taking and problem solving at the front lines, organizational systems and procedures can be changed to avoid many of the most prevalent recurring problems (sometimes referred to—perhaps overly optimistically—as "low hanging fruit").

We conducted a detailed study of hospital nursing care processes to investigate conditions under which nurses might respond to failures they encounter in their hospital's operational processes by actively seeking to prevent future occurrences of similar failures. Our research suggests that, in spite of increased emphasis on these issues, hospitals are not learning from the daily problems and errors encountered by their workers. We also find that process failures are not rare but rather are an integral part of working on the front lines of health care delivery.

Although this study focused on hospital nurses, the lessons learned have implications for managers in other service organizations as well. The tasks carried out by nurses are knowledge-intensive, highly variable, and performed in the physical presence of customers, which heightens the worker's focus on the current customer's comfort and safety and can detract from awareness of the need to improve the organizational system through which care is delivered. These aspects are similar to work environments of other service providers who perform complex physical and mental tasks in the presence of customers, such as computer help-desk operators, repair technicians, airline crews, fire fighters, police officers, teachers, beauticians, and some customer service representatives. Further, hospitals have many features in common with other service organizations, notably time pressure, unpredictability in the workload, the relatively low status of nurses as front-line employees, and their reliance on others for supplies and information. These features contribute both to the emergence of failures and to barriers to learning from them.

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Process Failures on the Front Lines of Hospital Care Delivery

Our research identified two types of process failures—problems and errors. We define an *error* as the execution of a task that is either unnecessary or incorrectly carried out and that could have been avoided with appropriate distribution of pre-existing information. For example, we observed a patient who had been unnecessarily prepared for colonoscopy at significant expense to the hospital and discomfort to the patient before the specialist reviewed her case—revealing that the patient was not an appropriate candidate for the procedure—and cancelled it.

Hospital errors have received considerable nationwide attention recently; however, an emphasis on only those errors that lead to severe consequences such as the death of a patient has perhaps obscured the subtler phenomenon of errors that take place within the care delivery process everyday—such as an unnecessary pre-operative preparation. Thankfully, most errors are caught and corrected before patients are harmed; however, a lack of attention to the process errors that precede more visible, consequential failures may limit opportunities for organizational learning.

The second type of failure is a *problem*, which we define as a disruption in a worker's ability to execute a prescribed task because either: something the worker needs is unavailable in the time, location, condition, or quantity desired and, hence, the task cannot be executed as planned; or something is present that should not be, interfering with the designated task.[6] Examples of problems include missing supplies, information, or medications. Unlike errors, work-process problems have received little attention in the literature or press. Like errors, problems are a valuable source of information about ways in which the system is not working.

Whereas workers can take action to solve problems, prevention of errors necessarily requires management involvement to redesign work systems.

Workers are well aware of the problems they encounter. In contrast, by definition, people are unaware of their own errors while making them. Not surprisingly, given that we observed the work processes from the viewpoint of front-line workers, the majority (86%) of the failures we observed in the care delivery process were problems rather than errors. Both kinds of failures require some kind of action for patient care to continue effectively. Whereas workers can take action to solve problems—due to their intense awareness of them—prevention of errors necessarily requires management involvement to redesign work systems in ways that make errors less likely to occur.

Research Base

In this article, we summarize findings from an in-depth study of work system failures on the front lines of care delivery in hospitals. We analyzed qualitative data from 239 hours of observation of 26 nurses at nine hospitals to develop understanding of and recommendations for organizational learning from process failures.[7] After completing the observations, we conducted interviews with twelve nurses at seven of the hospitals studied.[8]

Nursing units provide a rich context for studying problem solving. First, nurses are typically experienced and capable problem solvers because their profession requires a high level of cognitive reasoning and discretionary decision making.[9] For example, nurses coordinate patients' care with support functions such as diagnostic tests and physical and respiratory therapy, pulling together and interpreting data to recognize ominous patterns that warrant contacting

physicians to intervene when a patient takes a turn for the worse. In addition, they provide direct patient care, including assessing patients' condition, administering medications, bathing and moving patients to prevent bed sores, providing treatments (e.g., blood transfusions, dressing changes), and educating patients (and their families) about their medical conditions. Nurses usually have multiple patients and meeting *all* of their physical and emotional needs is challenging, if not impossible. Consequently, nurses continually evaluate what needs to be done, reprioritizing their tasks to meet patients' changing needs. Second, the unpredictable nature of health care and the high level of interdependence among service-providing employees[10] (e.g., nurses, doctors, pharmacy, central supply, and laboratory) make it likely that nurses will encounter failures in the course of their day-to-day work.

With the exception of the first hospital, a community hospital actively engaged in an organizational change effort, we purposely sought hospitals with reputations for nursing excellence by asking nursing governing boards for referrals to such hospitals and by searching nursing magnet literature for hospitals nationally recognized for nursing excellence. Our goal was not gather a representative sample of hospitals, but instead to assess how excellent nursing hospitals handled service failures, while also ensuring that our findings were not biased by results from only one organization. By including multiple excellent organizations, we were able to discern that the basic pattern of problem-solving behavior was similar across these nine across hospitals, with only modest variation from site to site. These hospitals are described in Table 1, using pseudonyms to protect their confidentiality.[11]

Failures on the Front Lines of Care Delivery

We characterized the nature of the failures we observed on the front lines of patient care delivery, and subsequently we examined nurses' responses to them. We encountered 194 failures during our observations. Problems constituted the majority (166) of these data. Nurses experienced five broad types of problems: missing or incorrect information; missing or broken equipment; waiting for a (human or equipment) resource; missing or incorrect supplies; and simultaneous demands on their time.[12] Problems were most likely to surface while nurses were preparing for patient care (88% of the problems) and/or as a result from a breakdown in information or material transfer to the nurse (91% of the problems), highlighting the boundary-crossing nature of this kind of process failures. This finding is further reinforced in interviews. Five of the twelve nurses interviewed noted that although nurses should take responsibility for trying to improve how things work, many problems stem from other groups and departments. An oncology nurse commented on her perception that downstream, internal support departments were the source of many disruptions:

> "The daily problems we face are from outside of our own unit—central supply and housekeeping, for example. It is not the people on the unit. It is not what we do or don't order for our supplies. It is a system problem."

TABLE 1. An Overview of Hospitals where Observation of Workers Occurred

Hospital	Type of Hospital	Number of Beds	Nursing Units Observed	Unionized Nurses	Observation Time (hours:min)	% of Total Observation Hours	# of Nurses Interviewed
1	Small Community	47	Intensive Care Unit	Non-Union	82:35	34%	0
2	Specialty, Urban, Teaching	98	Surgical	Non-Union	7:45	3%	0
3	Rural Community	134	Medical/ Surgical	Union	27:19	11%	2
4	Community, Private Not-For-Profit	243	Surgical and Maternity	Non-Union	34:30	14%	1
5	Community, Government	292	Oncology & Medical/ Surgical	Union	15:35	7%	3
6	Community, Government	250	Cardiac	Union	1:30	1%	1
7	Teaching, Urban	198	Oncology	Non-Union	20:30	9%	2
8	Pediatric, Teaching, Urban	163	Oncology	Union	9:11	4%	1
9	Teaching, Tertiary Care	433	Intensive Care Unit	Non-Union	40:30	17%	2
Total					**239:25**		**12**

Second, we observed 28 errors, which fell into three categories: incorrect actions made by the nurse (39%), errors made by other people (18%), and unnecessary execution of tasks resulting from faulty process flows (43%). Examples of these three categories respectively include a nurse who forgot to give a patient his medications for the entire shift, nurses having to correct mistakes made by the previous shift's nurse (i.e., a patient's diet entered incorrectly in the computer system), and nurses beginning to transfer a patient to another unit before receiving information from surgeons (and in two cases, family members) that reversed the transfer decision.

Distinguishing between problems and errors highlights the different roles front-line employees can play in improvement. The relative visibility and frequency of problems, compared to errors, makes them accessible to front-line workers who are well positioned to suggest important changes that managers would not be able to identify. Second, problems carry less stigma than errors, making discussion of them less interpersonally threatening.[13] Understanding how front-line employees respond to problems is thus important for efforts to improve work systems and processes.

First-Order Problem Solving

Research on quality improvement has distinguished between two types of response to problems—short-term remedies that "patch" problems and more thorough responses that seek to change underlying organizational routines to prevent recurrence.[14] We make a similar distinction between first- and second-order problem-solving behavior in service organizations.[15] First-order problem-solving behavior occurs when the worker compensates for a problem by getting the supplies or information needed to finish a task that was blocked or interrupted. The worker does not address underlying causes, thus not reducing the likelihood of a similar problem in the future. In our research, we found that nurses implemented a short-term fix for the overwhelming majority of the failures observed, enabling them to continue caring for their patients, without taking any action to try to prevent recurrence of similar failures—that is, without prompting organizational learning. For example, an oncology floor nurse who worked on the night shift ran out of clean linen to change her patients' beds. She walked to another unit that had linen in stock and took from their supply.

At first glance, first-order problem solving seems successful: the nurse was able to obtain linen. The cost to the nurse and to the hospital was minimal; it only took a few minutes of her time and was inexpensive. Notably, this nurse did not pay for a taxi to deliver the linen from an off-site linen cleaning service, which nurses at other hospitals reported as how they often handled the problem of running out of certain supplies, including linen. Seven out of nine nurses whom we interviewed reported feeling gratified when they figured out a way to work around an obstacle enabling them to continue patient care. The nurse missing linens commented,

> "Working around problems is just part of my job. By being able to get IV bags or whatever else I need, it enables me to do my job and to have a positive impact on a person's life—like being able to get them clean linen. And I am the kind of person who does not just get one set of linen, I will bring back several for the other nurses."

Upon further reflection, it appears that first-order problem solving can be counterproductive. It keeps communication of problems isolated so that they do not surface as learning opportunities. Workers rarely inform the person responsible for the problem, which prevents those people from learning that their processes could be improved. Sometimes, first-order problem solving creates new problems elsewhere, as when the above nurse took several sets of linens from another area. Moreover, considerable time (of highly paid professionals) is wasted on tasks and rework that would not otherwise be necessary. We found that, on average, 33 minutes were lost per eight-hour shift due to coping with system failures that could have been addressed and removed. Thus, first-order

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problem-solving behavior, ironically, can preclude improvement by obscuring the existence of problems and errors and preventing operational and structural changes that would prevent the same failures from happening again.

Our analysis identified two implicit strategies, or more colloquially, rules-of-thumb that exemplify first-order problem solving. The first rule of thumb is as follows: when you encounter a problem, do what it takes to continue the patient-care task—no more, no less. When nurses used this rule—which they did for 93% of the problems—their behavior involved securing the information or material they needed to do their jobs without probing into what caused the problem to occur. After the nurses were able to resume caring for the patient, they did not expend further effort on the incident; that is, they neither communicated that it occurred to others nor sought to investigate or change causes. This strategy served several purposes. It allowed a nurse to meet the requirements of the current patient—a responsibility that the nurses we observed did not take lightly. It also reduced the amount of time the harried nurse spends away from patient care duties; engaging in extra activity beyond the immediate fix would be a further drain on the care current patients received.

The second rule of thumb was—when necessary for continuity of patient care—to ask for help from people who were socially close rather than from those who were best equipped to correct the problem. The second rule of thumb helped to preserve the nurse's reputation regarding his or her competence at handling the daily rigors of nursing. In addition, it allowed nurses to avoid unpleasant encounters with cantankerous physicians or managers as long as possible. At the same time, it all but precluded addressing underlying causes that might improve the system. The nurses followed this rule for 42% of the problems and deviated from it for only 7% problems (e.g., they contacted a physician or other hospital personnel rather than attempting to solve the problem on their own).[16] The appeal and power of rules of thumb upon which one can tacitly rely in a time-pressured situation may help explain the high level of consistency of nurses' responses to problems.

Second-Order Problem Solving

Second-order problem-solving behavior occurs when the worker, in addition to patching the problem so that the immediate task at hand can be completed, also takes action to address underlying causes. Second-order problem solving includes: communicating to the person or department responsible for the problem; bringing it to managers' attention; sharing ideas about what caused the situation and how to prevent recurrence with someone in a position to implement changes; implementing changes; and verifying that changes have the desired effect. Given that nurses have so little spare time for extensive second-order problem-solving behavior such as tracking the problem to its source and making system changes to prevent recurrence, we categorized any behavior that called attention to the situation—thereby starting a legitimate process of inquiry into root cause which could then transpire over a period of time—as indicative

of second-order problem-solving behavior. Nonetheless, only 7% of nurse responses met even these lenient criteria.

To illustrate second-order problem solving in this context, we observed an inexperienced intensive-care unit (ICU) nurse transfer a two-year old patient to the oncology floor by mistakenly leaving the sleeping child on his ICU bed rather than moving him onto the standard hospital bed in his new room, despite the protests of the oncology nurse that the highly-specialized ICU beds had to be returned. Not unexpectedly, the ICU nurse manager called the oncology unit secretary 30 minutes later, asking for the ICU bed. The oncology nurse—instead of simply returning the bed—did something that was unusual, and certainly not necessary for the immediate care of her patient. She called the ICU nurse manager, explaining, "I don't want to get anyone in trouble, but I want you to know what happened so you can talk to the nurse so that it does not happen again."

In this example, the nurse took care of the immediate situation—getting the ICU bed back to the unit—and *also* took action to try to remove the underlying cause of the error—the new ICU nurse's mistaken belief that it was worse to move a sleeping child than to leave an ICU bed on another unit. The ICU nurse manager could then ensure that all ICU nurses were aware of this requirement. The oncology nurse's apologetic introduction, when calling the ICU to engage in system-correcting behavior, is perhaps indicative of how counter-normative such behavior can be in hospitals. Instead of being governed by tacit rules-of-thumb that everyone seems to follow without explicit decision, second-order problem solving seemed to take conscious effort.

Second-order problem solving can have positive consequences for workers and the organization. If the worker's action is successful and the problem does not recur, they will not have to face similar obstacles in the future. As a result, second-order problem solving is a way that real change is achieved. The organization can benefit from higher productivity, customer satisfaction (because service is not interrupted), and worker satisfaction (feelings of competence from improving their work systems and less frustration with completing their tasks).

Three Positive Human Resource Attributes that Prevent Learning

Why aren't hospitals—and we suspect many other service organizations as well—learning all they can from daily problems encountered by their workers? Our research suggests that it is not because problems are highly complex or difficult to solve, nor is it because nurses are unmotivated—two plausible explanations. The problems we observed, while often requiring some sort of system change for resolution, were neither ill defined nor technically challenging. Instead, they were relatively straightforward and embedded in routine processes; typical examples included missing medications, regular-diet food trays being delivered for diabetic patients, insufficient supplies, and a lack of necessary medical orders for patient care.

It is also not because nurses are uncommitted, lazy, or incompetent. The nurses studied were extremely dedicated and capable, often possessing advanced degrees and all had worked more than three years on their unit. Nine out of ten nurses whom we observed for an entire shift stayed an average of 45 minutes after their shift had ended—without extra pay—to complete their patient care duties. They ate their lunches in much less time than allotted and postponed taking personal breaks in order to provide the care they felt their patients deserved. One nurse, who worked from 7:00 A.M. until 7:00 P.M. called the unit at 4:00 A.M. after waking up, suddenly remembering something she had forgotten to tell the nurse who took over caring for her patients.

The lack of organizational learning from failures can be explained by an emphasis on individual vigilance, unit efficiency concerns, and empowerment.

The lack of organizational learning from failures can be explained instead by three less obvious, even counterintuitive, reasons: an emphasis on individual vigilance in health care, unit efficiency concerns, and empowerment (or a widely shared goal of developing units that can function without direct managerial assistance). These three factors, while seemingly beneficial for nurses and patients alike, can ironically leave nurses undersupported and overwhelmed in a system bound to have breakdowns because of the need to provide individualized treatments for patients.

First, individual vigilance—an industry norm that encourages nurses and other health care professionals to take personal responsibility to solve problems as they arise—is explicitly developed and highly valued in health care organizations. Counterintuitively, this can create barriers to organizational improvement because, in addition to encouraging individuals to be alert to things that can go wrong and to quickly take action, norms of individual vigilance encourage independence. Each caregiver thus tends to work on completing her or his own tasks without altering common underlying processes. Nurses are allowed, and even encouraged, to resolve problems independently without having to consider the impact on the system. In this way, problems of missing supplies or equipment tend to be resolved by taking the necessary items from somewhere else, hence creating another problem downstream. We found that nurses' problem-solving action tended to be directed at meeting immediate needs of patients; its scope rarely included assessing or remedying underlying causes—even when similar problems were confronted consecutively—making the chances of spurring organizational improvement and change through such efforts remote.

Second, nursing units were designed to maximize individual unit efficiency. Nursing labor is expensive and in short supply. Understandably, hospitals can ill afford to have nurses routinely working with slack resources. This staffing model leads to an organizational design where workers do not have time to resolve underlying causes of problems that arise in daily activities. Instead, nurses are barely able to keep up with the required responsibilities and are in essence forced to quickly patch problems so they can complete their immediate

responsibilities. Thus, in this situation it is possible for an individual worker to be working non-stop while the content of the work technically adds little value to the customer's experience because of the amount of rework and unnecessary steps.

Third, empowerment of workers has been cited as a solution for quality and productivity problems.[17] The flip side of empowerment, however, is the removal of managers and other non-direct labor support from daily work activities, leaving workers on their own to resolve problems that may stem from parts of the organization with which they have limited interaction. Reducing the degree to which managers are available to front-line staff can be a loss for improvement efforts, especially when workers are already overburdened by existing duties. Managers tend to have a broader perspective than line workers, possess status necessary to resolve problems that cross organizational boundaries, and are capable of implementing solutions on a wider basis. This is not to say that nurses are not capable of engaging in such activities, but rather that the immediate nature of their duties precludes them from spending large amounts of time away from patient care. Without a readily available nurse manager, they are left without anyone to assist them in making these connections.

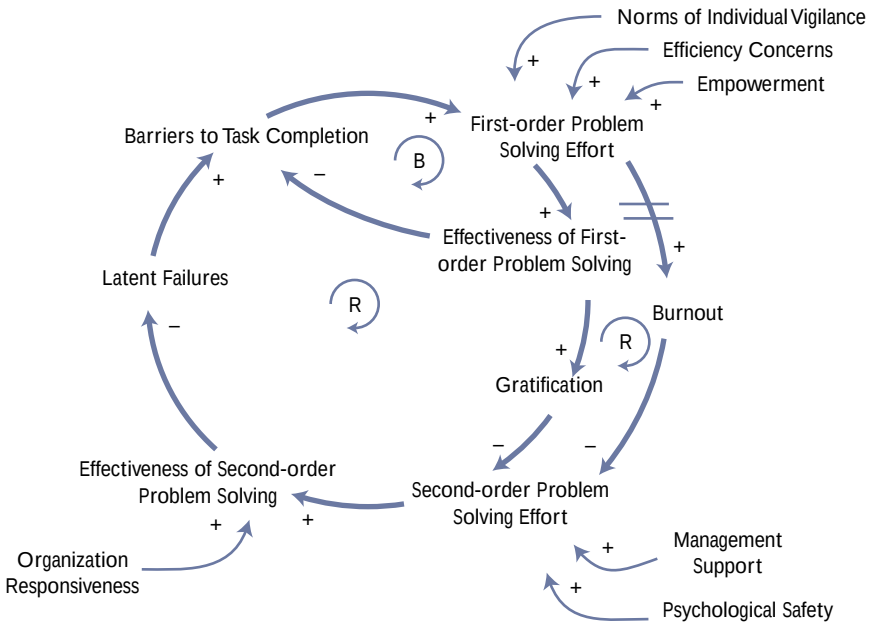
An Illusory Equilibrium Created by Responses to Process Failures

When a problem arises, a worker needs to engage in first-order problem solving merely to be able to continue his or her duties. First-order problem solving, however, does not alter the underlying conditions that gave rise to barriers to task completion, and so the failure, or one just like it, is likely to recur. This means that although the behavior appears to provide a solution, the solution, in fact, is a temporary measure. As a model of this dynamic phenomenon, Figure 1 depicts the causal relationships between these constructs.

The iterative relationship between problems (recognized by workers on the job as "barriers to task completion") and worker response (first-order problem-solving effort) is a dynamic structure of the type that researchers who study the dynamic properties of organizational systems have called a "balancing loop."[18] How it works is that the emergence of a problem (some disruption or barrier that would otherwise preclude the continuity of patient care) increases the chances (indicated by a plus sign in the thick arrow at the top of Figure 1) of a particular response—a first-order problem-solving effort. In turn, when this response successfully patches the problem, it reduces or removes the barrier (indicated by a minus sign next to the other thick arrow), allowing the caregiver to continue the patient care task.

This is a system in apparent balance. A problem shows up, action is taken, and the obstacle is gone—at least temporarily. As depicted in Figure 1, however, an increase in first-order problem solving actually *reduces* the likelihood that underlying causes will be addressed. First, the more effort expended in first-order problem solving, the less likely he or she is to have and take time to

FIGURE 1. Model of First-Order and Second-Order Problem-Solving Behavior



engage in second-order problem-solving behavior. Because first-order problem solving takes time, it can leave workers with less flexibility to investigate causes and negotiate potential countermeasures.

A more subtle mechanism through which second-order problem-solving effort is reduced is the feelings of gratification that nurses report when effectively overcoming problems on their own. One nurse expressed her satisfaction when she was able to resolve issues that were preventing her from caring for her patients, "I have a lot of job satisfaction when I go home and I feel like I did everything that a patient needed and was entitled to. Even the little things." Ironically, this rewarding feeling of competence and self-sufficiency tends to further decrease the chances of expending effort to get others involved, as needed for second-order problem solving—and so the rate of failure emergence is not reduced. This is also depicted in Figure 1, in the positive link between effective first-order problem solving and worker feelings of gratification.

In most hospitals, organizational culture and management behaviors tend to reinforce this already-robust system of individual vigilance. Seventy percent of the nurses we interviewed commented that they believed their manager expected them to work through the daily disruptions on their own. Speaking up about a problem or asking for help was likely to be seen as a sign of incompetence. As one nurse interviewed explained, "My manager is not interested in hearing about things if they are small. If I went to her with a small problem, she would say, 'Solve it yourself.' To get any attention from managers,

problems have to be something that is out of your hands—something you can't solve on your own."

Further, to those directly involved, things seem to be working reasonably well. It is stressful, but basically in balance. The catch is—because first-order problem solving is time-consuming and tiring—over time, burnout begins to take its toll on the system. This time delay is represented in Figure 1 by two slash marks between first-order problem-solving effort and burnout. This symbol indicates that first-order problem-solving behavior leads to burnout—but not immediately. Frustration and exhaustion accumulate over time. Not surprisingly, worker burnout then further decreases the chances of effortful engagement in second-order problem solving (another causal arrow marked by a minus sign in Figure 1). In addition, less effort on second-order problem solving means its effectiveness or ability to reduce latent failures also goes down. To illustrate this, in our study, one nurse said, "I am quite burned out as a whole with nursing. I would quit tomorrow if I could find decent work with health insurance—even for less pay."

Over time, therefore, the apparent balance of this system is revealed as illusory. Workers experience an increasing sense of frustration, exhaustion and, in some cases, leave the organization—worn out by the task of swimming upstream against an incessant tide of small, annoying problems.

Over time, therefore, the apparent balance of this system is revealed as illusory. Workers experience an increasing sense of frustration, exhaustion and, in some cases, leave the organization—worn out by the task of swimming upstream against an incessant tide of small, annoying problems. Across the health care delivery industry, this phenomenon is contributing to unacceptably high levels of turnover in many organizations and to widespread nursing shortages.[19]

Levers for Change

The process of developing a causal feedback model suggests the location of leverage points for change. The model shown in Figure 1 depicts first-order problem-solving behavior as a "fix that fails,"[20] that is, it illustrates the all too human response to take action expediently when things go wrong in such a way that the situation seems to improve, in the short term. Over time, however, as shown by the model, the situation gradually worsens. Thus, the power of a causal feedback model such as this is that it calls attention to variables that are well positioned for creating more fundamental, long-term change. These leverage points constitute specific ways that managers can foster organizational learning efforts by front-line workers in hospitals and other service organizations.

As the model shows, the situation can only be improved in a real rather than illusory manner through second-order problem-solving behavior. To make this happen, managerial intervention is likely to be essential. Thus, a first lever

for change is management support, which can work deliberately to increase effort spent on second-order problem solving by front-line workers. This potential influence is depicted on the right side of Figure 1.

What do we mean by management support? To begin with, managers must make an effort to be regularly available for at least part of all shifts. We observed that the physical presence of managers increased the likelihood of managers being informed of problems occurring on the unit; this, in turn, allowed managers to investigate and support possible work system changes. Next, managers can counteract time pressure by providing assistance for front-line problem-solving efforts. In addition, by acting as role models of second-order problem solving, managers can teach workers to think about what could be done to prevent similar problems from occurring in the future.[21]

Second, to learn from failures, people need to be able to talk about them without fear of ridicule or punishment. Managers can help create an environment where workers feel safe taking the interpersonal risks that second-order problem-solving entails, thereby making this behavior more psychologically feasible (see Figure 1). Creating a psychologically safe work environment does not require managers be excessively warm and friendly, but instead that they invite others to express their concerns and model fallibility by admitting their own errors.[22]

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Third, managers and others in the organization must respond to initiative by following through on these suggestions and facilitating boundary-crossing improvements that help reduce the rate of problem emergence. In short, if second-order problem-solving effort does not lead to any positive changes, workers will be discouraged about spending their time on this in the future. One nurse commented, "I know nurses on our floor used to come up with suggestions for change. No one seems to listen and now no one bothers trying." Conversely, if the effort is effective (because the organization is responsive), workers' motivation to engage in second-order problem solving in the future will be strengthened. The left side of Figure 1 thus shows organizational responsiveness to nurses' attempts at second-order problem solving as a positive influence on the effectiveness of the effort.

Are these solutions feasible in the budget conscious world of health care? After all, most involve additional expenses, whether freeing up a manager to assist front-line workers with resolving failures, promoting more discussion of (and time devoted to) tracking down causes of problems, or implementing countermeasures. Further analysis suggests that the extra expense would pay off. Although second-order problem solving requires an investment in developing both human resources and organizational routines, over time the reduction in failures could pay for themselves. At a bare minimum, we can estimate that worker time wasted in work-arounds to cope with system failures was 8% of a shift. Even with conservative estimates, this amounts to $256,000 per year in lost nursing time for a 200-bed hospital.[23] Further, many nurses are currently

"subsidizing" the hospital by working through their breaks, lunch time, and working unpaid overtime in order to make up the time they lost because of system failures and inefficiencies. This generosity backfires when nurses leave the profession due to burnout.

The savings due to reductions in patient complications could be even greater. For example, we observed one patient who stayed in the intensive-care unit for an additional night because a preparatory medication did not arrive on the floor in time and his procedure had to be delayed until the following day. Such discharge delays are extremely expensive for the hospital as they are reimbursed for a category of services provided, not by their actual costs of providing each service.[24] Moreover, many hospitals are capacity constrained, and so an extra day is a day that could have been provided to another patient.

The burden of learning from failures does not lie solely with managers. Workers must take specific actions, suggesting a list of desirable behaviors by front-line workers that differs in important ways from conventional wisdom about the ideal employee. For example, most managers would identify an ideal employee as one who can handle with ease any problem that comes along, without bothering managers or others. From an organizational learning perspective, this is questionable wisdom. The ideal employee is instead a noisy complainer, who speaks up to managers and others about the situation, thereby running the risk of being seen as someone who lacks self-sufficiency. Similarly, instead of quietly correcting others' errors without making a fuss, a front-line worker should be a nosy troublemaker, actively pointing out colleagues' mistakes. Third, the ideal employee for organizational learning does not convey an impression of flawless performance but rather openly acknowledges his or her own errors. This self-aware error-maker not only facilitates correction but also speaks up about process failure and thus contributes to a climate of openness in which others can do likewise. Finally, the ideal employee is a disruptive questioner who won't leave well enough alone. This person is constantly questioning, rather than accepting and remaining committed to, current practices. These differences are summarized in Table 2.

Conclusions

Our study shows that it is difficult for hospital workers to use problems as opportunities for improvement. The dynamic pattern described in this article is not unique to hospitals, although it may be exaggerated in health care by the task variability, the extreme time pressure faced by workers, and the increasing cost pressures faced by hospitals. Other service contexts present similar features. For example, many service workers are motivated by the rewarding sense of self-sufficiency that led some of the nurses we observed to avoid reporting or getting help for fixing system failures.

Many service organizations are not learning all they can from their failures. Complex systems, like the ones used by most organizations to provide the services their customers buy, are bound to suffer from failure and poor design.

TABLE 2. Comparison of Traditional and Learning Views of Desirable Employee Behaviors

When the Employee Faces:	"Ideal Employee" Behaviors	Employee Behaviors Conducive to Organizational Learning
Missing materials or information	Adjust to shortcomings in materials and supplies without bothering managers or others.	*Noisy Complainer*: Remedies immediate situation but also lets the manager and supply department know when the system has failed.
Others' errors	Seamlessly corrects for errors of others – without confronting the person about their error.	*Nosy Troublemaker*: Lets others know when they have made a mistake with the intent of creating learning, not blame.
Own errors and problems	Creates an impression of never making mistakes.	*Self-Aware Error-Maker*: Lets manager and others know when they have made a mistake so that others can learn from their error. Communicates openness to hearing about their errors discovered by others.
Subtle opportunities for improving the system	Committed to the current way of doing business—understands the "way things work" around here.	*Disruptive Questioner who won't let well enough alone*: Questions why do we do things this way? Is there a better way of providing the service to the patient?

Therefore, not hearing anything about what kinds of failures workers are experiencing is more likely to mean that managers are not present and receptive enough for workers. The lack of communication does not mean there are no problems. The clues managers can look for include worker frustration that input is not heard and a resigned sense that "nothing ever changes around here." As one nurse mused, "I do not feel that my voice is heard. Often I am discouraged, so I don't input my ideas. Where would my ideas go? We are not asked for input." Over time, this leads to a sense of futile resignation that the problems are going to always be there because nothing gets resolved.

Even in the most successful service organizations, work system failures will occur. Both errors and problems can be detected and used as launching points for organizational learning and improvement by motivating changes to avoid recurrence. Front-line service providers are in the best position to discover and remove this type of work system failure. Managers have an essential role: assisting with problem-solving efforts, providing support for workers who attempt to improve their work systems, and valuing them as motivated employees. By reframing workers' perceptions of failures from sources of frustration to sources of learning, managers can engage employees in system improvement efforts that would otherwise not occur.

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Notes

1. For a report the poor financial state of hospitals in general, see for example, C. Kramer and D. Dalmand, "Ernst & Young/HCIA-Sachs Study Finds Continued Financial Woes for Hospitals on May Day," *Ernst & Young/HCIA-Sachs* [Electronic] (2001), accessed on October 8, 2002.
2. This often cited statistic comes from L.T. Kohn, J.M. Corrigan, M.S. Donaldson, "To Err Is Human: Building a Safer Health System," (Washington, D.C.: National Academy Press, Committee on Quality of Health Care in America, Institute of Medicine, 2000).
3. Many researchers have written about the pervasiveness of medical errors in hospitals. For one of the most influential studies, see L.L. Leape, D.W. Bates, D.J. Cullen, et al. "Systems Analysis of Adverse Drug Events," *Journal of the American Medical Association*, 274/1 (1995): 35-43.
4. Both the popular press [J.P. Shapiro, "America's Best Hospitals," *U.S. News and World Report* (2000)] and the medical community [E.C. Nelson, P.B. Batalden, T.P. Huber, et al., "Microsystems in Health Care: Part I, Learning from High-Performing Front-Line Clinical Units," *Joint Commission Journal of Quality Improvement*, 28 (September 2002): 472-497] have turned their attention to flaws in the operational systems through which care is provided.
5. Sim Sitkin has argued that small failures are excellent sources of learning because they indicate that current processes can be improved upon, without causing organizations to respond defensively as large failures are likely to do, which would inhibit effective learning. S. B. Sitkin, "Learning through Failure: The Strategy of Small Losses," in L.L. Cummings and B.M. Staw, eds., *Research in Organizational Behavior*, 14 (1992): 231-266. For articles that discuss the role of front-line workers in solving operational problems, see J.P. MacDuffie, "The Road to 'Root Cause': Shop-Floor Problem-Solving at Three Auto Assembly Plants," *Management Science*, 43/4 (1997): 479-502; A. Mukherjee, M. Lapre, and L.N. Van Wassenhove, "Knowledge Driven Quality Improvement," *Management Science*, 44/11 (1998): S35-S49; S.J. Spear, "The Essence of Just-in-Time: Imbedding Diagnostic Tests in Work-Systems to Achieve Operational Excellence," *Production Planning & Control* (forthcoming).
6. The phenomenon of workers lacking supplies at the point and time at which they need it has been studied in depth by Steven Spear. His research into the Toyota Production System epitomized careful ethnographic observation of operating systems and the findings demonstrated the insight that this method can produce. See S. J. Spear, "The Toyota Production System: An Example of Managing Complex Social/Technical Systems: 5 Rules for Designing, Operating, and Improving Activities, Activity-Connections, and Flow-Path," unpublished doctoral dissertation, Harvard Business School, 1999.
7. For a more detailed explanation of the research methods used in this study, see A.L. Tucker, A.C. Edmondson, and S.J. Spear, "When Problem Solving Prevents Organizational Learning," *Journal of Organizational Change Management*, 15/2 (2002): 122-137.
8. Given the time that had elapsed, we were unable to gain additional access to two of the hospitals.
9. The nursing literature has emphasized the importance of critical thinking, the cognitive component of nursing work. For examples, see R. Hansten and M. Washburn, "Individual and Organizational Accountability for Development of Critical Thinking," *Journal of Nursing Administration*, 29/11 (1999): 39-45; J.L. Lee, B.L. Chang, M.L. Pearson, K.L. Kahn, and L.V. Rubenstein, "Does What Nurses Do Affect Clinical Outcomes for Hospitalized Patients? A Review of the Literature," *Health Services Research*, 34/5 (1999): 1011-1032; C. Taylor, "Problem Solving in Clinical Nursing Practice," *Journal of Advanced Nursing*, 26 (1997): 329-336.
10. The complications caused by the interdependence of healthcare workers are discussed in S. Glouberman and H. Mintzberg, "Managing the Care of Health and the Cure of Disease—Part I: Differentiation," *Health Care Management Review*, 26/1 (2001): 56-69.
11. The close proximity of Hospital 1 to our offices, combined with the willingness of its intensive-care unit manager to allow us extensive access, led to more hours of observation at Hospital 1 than was possible with the other institutions. In addition, Hospital 1 was the first site in which nurses were observed in this study. We thus spent considerable time at this site to develop a deep understanding of and ability to decipher hospital care processes before approaching other hospitals for access. Despite spending more time at this site than any other, however, by the end of data analysis, we were able to conclude that the incidents and behaviors observed at Hospital 1 were typical of those observed at the other eight sites. Further Hospital 1 was solidly in the "middle of the road" in terms of both problems and

nurse responses. In sum, our over-sampling of problems at this site does not pose a serious threat to the generalizability of our findings.

12. To compute inter-rater reliability for the types of problems, a random sample of ten observation days was evaluated independently by two non-nurse reviewers. The kappa statistic, which adjusts the rating downward to compensate for the probability that raters could assign items to the same category by chance, was appropriate to use in this situation. The kappa value was 0.88 for judgments about problem type, which is considered almost perfect by Landis and Koch. See J.R. Landis and G.G. Koch, "The Measurement of Observer Agreement for Categorical Data," *Biometrics*, 33 (1977): 159-174.
13. Previous research has established a positive relationship between the degree to which workers feel safe taking interpersonal risks and the amount of errors that are reported. See A.C. Edmondson, "Learning from Mistakes Is Easier Said than Done: Group and Organizational Influences on the Detection and Correction of Human Error," *Journal of Applied Behavioral Science*, 32/1 (1996): 5-28, and A.C. Edmondson, "Psychological Safety and Learning Behavior in Work Teams," *Administrative Science Quarterly*, 44/2 (1999): 350-383.
14. This pattern of simply fixing the problem rather than doing something to prevent its recurrence is also reminiscent of reactive versus preventive control, as discussed in R.H. Hayes, S.C. Wheelwright, and K.B. Clark, *Dynamic Manufacturing: Creating the Learning Organization* (New York, NY: Free Press, 1988). Similarly, John Carroll and his colleagues explore this phenomenon with regards to accident reviews undertaken by nuclear power plant employees, see J.S. Carroll, J.W. Rudolf, and S. Hatakenaka, "Learning from Experience in High-Hazard Organizations," *Research in Organizational Behavior* (forthcoming). Nelson Repenning and John Sterman contrast two types of process improvement, first-order improvement and second-order improvement, see N. Repenning and J.D. Sterman, "Capability Traps and Self-Confirming Attribution Errors in the Dynamics of Process Improvement," *Administrative Science Quarterly*, 47 (2002): 265-295.
15. Our concept of first and second-order problem solving is analogous to Argyris and Schon's notion of single and double loop learning. C. Argyris and D. Schon, *Organizational Learning: A Theory of Action Perspective* (Reading, MA: Addison-Wesley Publishing Company, 1978). It also draws from problem-solving literature in which a distinction is made between patching problems and actually removing underlying causes.
16. The reluctance to contact others about problems was common across all types and sizes of hospitals, including teaching hospitals where one might expect nurses to feel more comfortable exerting their expertise given the substantial population of inexperienced physicians-in-training and students. In fact, for the twelve instances when nurses *did* contact the source, five (42%) were from Hospital 1—a non-teaching hospital and the smallest in our sample—with another three (67% in total) from non-teaching hospitals 4 and 5. The remaining four occurred at teaching hospitals 2, 7, and 9. Furthermore, doctors were contacted immediately for only two problems, both times at community hospitals. Therefore, we conclude that reluctance to confront physicians does not systematically vary by hospital size or teaching status.
17. Linda Aiken and her colleagues found that empowerment of nurses is associated with high-quality care and low nursing turnover. L.H. Aiken, and P.A. Patrician, "Measuring Organizational Traits of Hospitals: The Revised Nursing Work Index," *Nursing Research*, 49/3 (2000): 146-153.
18. For a detailed explanation of system dynamic models, see P.M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York, NY: Doubleday Currency, 1990). Two excellent articles that utilize system dynamics models to explain how organizations become trapped in self-reinforcing patterns of sub-optimal behaviors and, thus, poor performance are E.K. Keating, R. Oliva, N.P. Repenning, S. Rockart, and J.D. Sterman, "Overcoming the Improvement Paradox," *European Management Journal*, 17/2 *(*1999): 120-134; Repenning and Sterman, op. cit.
19. The connection between organizational factors—including the quality of hospital work processes—and the nursing shortage is discussed in R.C. Coile, Jr., "Magnet Hospitals Use Culture, Not Wages, to Solve Nursing Shortage," *Journal of Healthcare Management*, 46/4 (2001): 224-227.
20. Senge, op. cit.
21. For more on the role of the manager or a dedicated problem-solving support person in a hospital, see S.J. Spear, "Deaconess-Glover Hospital Case (B)," case no. 9-601-023, Harvard Business School, 2001.

22. For a discussion of leader behaviors associated with high psychological safety, and thus high team learning, see A.C. Edmondson, R. Bohmer, and G.P. Pisano, "Speeding Up Team Learning," *Harvard Business Review*, 79/9 (2001): 125-134.
23. Assuming average annual salary of $40,000 per nurse, the wasted nursing time is $3,200 per full-time nurse. For a 200-bed unit—the average size hospital in our sample—at 80% occupancy and a 6:1 staffing ratio operating 3 shifts per day, this amounts to $256,000 per year.
24. Industry experts estimate that it costs between $1500 and $2000 per day to keep a patient in the ICU.