Fixation and Vagabonding—The 2 Faces of Self-Fulfilling Interpretation

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Understanding and improving diagnostic skills under time pressure is a crucial aspect of patient safety and quality for physicians in many clinic and acute-care settings. Yet diagnostic errors account for up to 17% of adverse events in clinical settings, and multiple studies suggest diagnostic errors occur at rates typically estimated near 15%.1–3 Delayed or missed diagnoses can cause adverse outcomes ranging from minor events to the preventable death of a patient.1 To avoid such errors and make effective treatment choices on the front lines of patient care, clinicians have to answer the question, “What is going on here?”

Developing a differential diagnosis in a measured, rational fashion—one in which the clinician carefully considers options, evaluates the baseline probabilities of possible diagnoses, and then chooses the diagnosis that best fits the available data—is often held as an ideal.4,5 While this ideal sounds appealing, unfortunately it rarely captures the challenging character of diagnosis “in the wild.”6,7

Diagnosis is inherently a dynamic problem-solving process that rarely takes place under ideal conditions. The process usually occurs in a context of:

- Constrained resources
- Ambiguous and uncertain information
- High stakes
- Multiple simultaneous problems
- Vague and often conflicting goals
- Time pressure from both clinical urgency and performance metrics7,8

Effective performance also often requires coordinating multiple providers across different specialties and status levels. Not only do such contexts make diagnosis difficult, but they also present significant impediments to improving diagnostic skill through experience.1,9

Studying real-life diagnostic problem solving

The authors, funded by a National Patient Safety Foundation (NPSF) research grant in 2000, set out to understand diagnostic problem solving in realistic, high-stakes situations. High-fidelity health care simulations provided a convenient laboratory to study dynamic problem solving. The authors examined a rich data set comprising observations, videos, transcripts, and post-scenario debriefings from a study of 39 subjects each taking part separately in a high-fidelity medical simulation as part of routine training.10

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In each of the 39 cases of the same simulated scenario, the anesthesiologist (the subject of the study) is called to the operating room to take over anesthesia for a 29-year-old female who urgently needs an appendectomy. Soon the anesthesiologist notices that the ventilator bellows are straining, the patient’s breathing sounds are distant, and the monitor indicates that the patient’s blood oxygen levels are falling below the desired range.

The anesthesiologists recognized this as a potentially life-threatening situation calling for quick resolution to restore the patient’s breathing. In the 25 minutes following the onset of this crisis, the anesthesiologists attempted to solve...
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this diagnostic challenge, but only 18% of them did so in time to save the patient. The patterns in the “failure modes” of the others offer an illuminating look into the challenges of dynamic problem solving.\(^11\)

The failure mode of fixation: Premature closure
The first example is Dr. Poggioli (a pseudonym), who noticed a problem ventilating the patient. Based on the symptoms he observed and his likely expectations, Poggioli began treating bronchospasm, a fairly standard post-intubation problem and a highly plausible diagnosis, given the timing and constellation of presenting symptoms. Over the next 25 minutes, he appeared to consider only 1 alternative diagnosis. He made statements at least 10 times during the simulation reflecting his belief that the patient was in bronchospasm.

Like other clinicians in this failure mode (28% of the subjects), Poggioli conducted tests that largely aimed to confirm his presumed diagnosis. The core weakness in this mode is that the clinicians continually interpreted data in favor of their current diagnosis (eg, they heard the distant breath sounds as wheezes; they assumed the problematic high pressure the mechanical ventilator needed to inflate the lungs had fallen after giving medicine to treat for their diagnosis, when in fact it had not).

Why do these failure modes occur?
To explain why fixation and other failure modes occur, the authors developed a model of dynamic problem solving that incorporates 2 core ideas:\(^11\)

1. The clinician’s belief (or confidence) in the current diagnosis sometimes biases the interpretation of ambiguous information in favor of the current diagnosis.

2. The process of gathering and interpreting information (eg, diagnostic test results) used to update beliefs takes place in the context of considering competing diagnoses that may displace the current diagnosis as the preferred one.

Failure mode #1: Fixation
This failure mode unfolds as diagrammed in Figure 1. The diagnostician begins with some initially plausible diagnosis. As her Belief in Current Diagnosis begins to increase, she is more prone to Interpretation Bias that will influence the interpretation of new information.

As new Diagnostic Cues Arriving continue (both from her actions and from the evolving situation), the biased interpretations lead to more Interpretations to Support Diagnosis, further strengthening the Belief in Current Diagnosis and still more Interpretation Bias. This forms a self-reinforcing feedback loop that lies at the heart of fixation error. When the interpretation bias is strong, the diagnostician is at great risk of committing fixation error—clinging to a single presumed diagnosis despite mounting cues that he or she is on the wrong track.

Typical remedies for the fixation problem are to step back, expand the frame, and broaden the set of options to consider.\(^12,13\) But these steps to avoid fixation may increase the risk of the most common failure mode in the study—vagabonding.

Failure mode #2: Vagabonding
Vagabonding is a pattern of jumping from one diagnosis to the next without fully evaluating the merits of the rejected ones.

In the simulation, Dr. Vayanos (a pseudonym) reported having difficulty ventilating the patient soon after putting her to sleep. The mechanical ventilator was straining, so he switched to “hand bagging”—squeezing air into the patient’s lungs himself—and adjusted the placement of the breathing tube to assure this was not the problem. Talking

Figure 1. Self-fulfilling feedback in the interpretation of diagnostic cues. The “R” signifies a reinforcing feedback loop. When a variable changes in the upward (downward) direction, the loop acts to reinforce the change resulting in further change in the upward (downward) direction.

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Peter Senge, who introduced the theory of learning organizations, defined mental models as “deeply ingrained assumptions, generalizations, or even pictures and images that influence how we understand the world and how we take action.”1(p8) The mental models each individual generates around the term patient safety are a result of personal experiences and heuristics.

The National Patient Safety Foundation Web site includes 3 definitions of patient safety.2 Patient safety also has been defined by several other national organizations, including the Institute of Medicine (IOM),3 the Agency for Healthcare Research and Quality (AHRQ),4 and the National Quality Forum (NQF).5 These well-scripted definitions, while comprehensive, remain abstract.

At issue: The national definitions do not reflect personal mental models, which ultimately drive individuals’ actions and decision making.

What is the impact of individual definitions of patient safety?

A look into Hawaii’s statewide implementation of the national On the CUSP: Stop BSI (Comprehensive Unit-based Safety Program: Stop Blood Stream Infections) collaborative illustrates how varying definitions of patient safety can affect a program. The adult ICU subset of this Hawaii collaborative, which includes every adult ICU bed in the state, recently reported its first 18-month success in decreasing central line–associated bloodstream infection (CLABSI) by 61%6—double the decrease reported in the national cohort.7

NQF has defined eliminating CLABSI as a patient safety measure and consensus standard. However, defining success in patient safety can have multiple levels ranging from concrete to abstract. Table 1 shows these levels and their specific context within the CUSP: Stop BSI collaborative.

Team members with divergent mental models in the collaborative tended to struggle. For example, some teams included members who defined achieving success as a low-to-zero rate of CLABSI, while other team members defined achieving success as a unit-wide microsystem of mindfulness.

• The team members who focused on developing a microsystem attribute believed that every member of their unit needed to receive mandatory training on hard-wiring the science of safety, safety design principles and human factors. This, in their mental model, was a prerequisite toward creating unit-level mindfulness for problem solving CLABSI.

Table 1. Patient safety success levels and their context within the CUSP: Stop BSI collaborative

<table>
<thead>
<tr>
<th>Patient Safety Success Level</th>
<th>Context within CUSP: Stop BSI</th>
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<tbody>
<tr>
<td>Reducing a concrete measure of harm</td>
<td>Number of CLABSI/1000 catheter days</td>
</tr>
<tr>
<td>Reliable execution and practice of patient safety strategies</td>
<td>Learning from a defect, insertion checklist, daily goals sheet</td>
</tr>
<tr>
<td>Embracing patient safety as a discipline</td>
<td>Use of the CUSP method8 and science-of-safety design principles</td>
</tr>
<tr>
<td>Patient safety emerging as a microsystem, unit-based team, and organizational attribute</td>
<td>Mindfulness, appreciation, and trust for migrating expertise in problem detection and problem solving</td>
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• Team members who focused on the specific CLABSI rate as an outcome looked for specific strategies for reducing infections (eg, scrub the hub, use of a line cart). These implementation strategies were shared as a unit “need to know” approach. Deployment and in-services were about single “best practices.”
• Confusion occurred when the definition of mandatory in-services for part of the team meant understanding the use of the line cart and the 15-second scrub-the-hub regimen, while for others, those same mandatory in-services included a more comprehensive and longer-term set of programs.

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Interestingly, in the collaborative, teams with members who rallied around an attribute definition of patient safety accelerated their transformation of the CLABSI mental model from inevitable to preventable.

### Survey explores individuals’ patient-safety definitions

An upcoming issue of Patient Safety & Quality Healthcare will share results of an exploratory survey that reveal surprising information about how individual health care leaders define patient safety. Nearly 700 hospital executives, hospital board trustees, and physician leaders participated in a survey aimed at identifying personal definitions of patient safety.

The survey script was simple: “Define patient safety with 1-word definitions. No long prose or wordsmithing…just 1-word definitions. Try to come up with up to 10. You have 3-4 minutes…GO! Remember, only 1-word definitions.”

The survey was conducted during the 2009–2010 Estes Park Institute conference season. These conferences are designed to educate teams of health care executives, physicians, and trustees so they can exercise leadership and implement solutions to better serve their patients and local communities in a rapidly changing health care environment. Prior to the conference season, these leaders had named patient safety as the top issue confronting them as leaders.

### The results surprised everyone

Before sharing results, the target conference audiences predicted that 3–6 words would appear consistently on everyone’s list. However, none of the audiences had a single word consistently on everyone’s list. Not only was there no single word in common; more than 4,200 words were collected—1,270 of them unique.

### What do the survey results mean?

The exercise clearly establishes that mental models of patient safety can differ dramatically from one individual to another.

The exercise found patient-safety definitions occurring at many levels, including:

- A concrete avoidance of harm (eg, preventing hospital-acquired infections)
- A set of tools and designs (eg, failure mode and effects analysis, or FMEA)
- A discipline (eg, combining cognitive psychology and high-reliability engineering)
- An attribute (eg, mindfulness)

Organizations would be well advised to take time to share, discuss, and create a more common set of mental models to avoid ambiguity, faulty assumptions, and counterproductive activity.

### Considering Otto Sharmer’s levels of listening

Sharing and transforming mental models is an important part of any organization’s patient safety journey towards an ideal patient and clinician experience. Leaders must make this transformation possible.

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**The Estes Park Institute**

Since 1974, the Estes Park Institute of Englewood, Colorado (www.estespark.org), has been dedicated to helping health care professionals explore current trends, innovations, and solutions in health care.

Through its conferences, the Institute educates teams of health care executives, physicians, and trustees so they can exercise leadership and implement solutions to better serve their patients and all people in their local communities in a rapidly changing health care environment.

A useful framework to consider when leading transformation is described in Otto Sharmer’s Theory U. Sharmer’s early work included studying what it takes to create major shifts in thinking, such as the historic end of apartheid or the fall of the Berlin Wall.

Sharmer delineates 4 levels of listening in Theory U. Each level reaches deeper into the collective capacity.

- **Level 1.0**—A “downloading” mode. Notes and facts are absorbed to reconfirm one’s existing mental model.
- **Level 2.0**—A “debate” or best-practices mode. Other ideas are entertained and studied. Usually, the best practices are made to fit the existing mental model.
- **Level 3.0**—A “dialog” or shadowing mode. Sharing becomes a potential 2-way exchange. Visits are made to sister locations to see how things are done elsewhere. Although minor adjustments may be made to one’s mental model, more often, one continues to be cloaked in existing mental models and their accompanying agendas.
Impact of local campaigns for health care improvement

The axiom that “all culture is local” expresses a key principle for health care organizations that seek to implement patient safety improvement initiatives. When organizations employ tactics to generate buy-in and engagement of staff and patients in safety improvement efforts, it stands to reason that programs initiated with a distinct environment or community in mind are more apt to succeed.1 Engaging frontline staff has been documented to increase commitment and personal responsibility to the work2 and to generate creative ideas that otherwise may not have come forth.3 At the local level, common vision can unite a variety of stakeholders (patients and families, clinicians, and administrators) in a way that may not be feasible on a broader scale. Opportunities to draw synergies and align with national campaigns but do so in a way that addresses local concerns and strengths are just one way to empower communities—and the hospitals that serve them—to improve the safety of care. Patient Safety Awareness Week is one such vehicle for this strategy.

Patient Safety Awareness Week

Patient Safety Awareness Week (PSAW) is a national education and consciousness-raising campaign for improving patient safety at the local level. Hospitals and health care organizations across the country are encouraged to plan events to promote patient safety within their own organizations. Educational activities are centered on teaching patients about how to become involved in their own health care, as well as working with hospitals to build partnerships with their patient communities. Patient Safety Awareness Week was initially launched in March 2002 by Ilene Corina, president of PULSE of New York and then co-chair of the National Patient Safety Foundation’s Patient and Family Advisory Council.4

Activities that bring fun to the work of patient safety awareness

The NPSF patient safety LISTSERV® email discussion group has facilitated discussions over the years on activities organizations have taken on as a part of the Patient Safety Awareness Week observance. Many organizations held

**Patient Safety Awareness Week Themes**

2002: Inaugural observation
2003: Communication and Partnership: Safety Starts with All of Us
2004: Patient Safety: The Power of Partnership
2005: Focus on Patient Safety: Ask, Listen, Learn
2006: Our Patients, Our Partners: One Team, One Goal
2007: Patient Safety: A Road Taken Together
2008: Patient Safety: A Road Taken Together (reprised from 2007)
2009: A Prescription for Patient Safety: One Partnership, One Team
2010: Let’s Talk: Healthy Conversations for Safer Healthcare
2011: Are You In? Commit to Safe Health Care
2012: Be Aware for Safe Care
Focus on Patient Safety
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Patient Safety Awareness Week

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- Present awards for good catches
- Host a patient safety poster design contest in the organization and facilitate peer voting via intranet ballot
- Devise a “patient safety tip of the day” initiative for distribution via email, teleprompter, and hospital intranet
- Host a Partnering for Patient Empowerment through Community Awareness program in your hospital or community.

An organization can employ multiple tactics simultaneously as a multimodal approach to a Patient Safety Awareness Week initiative. For example, Wilford Hall Medical Center used several of the examples above in their PSAW observance to support the goals of increasing awareness of patient safety activities and promoting partnership among providers, patients, and communities.

Conclusion
By fostering collaborative engagement, spread of ideas, and sharing of knowledge, PSAW and other such programs can help communities, hospitals, clinicians, and patients achieve the common goals of awareness and safety improvement.

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with the second anesthesiologist he had called to help, Vayanos noted that the airway pressures were very high and wondered aloud if the problem could be asthma or not enough muscle relaxation in the patient.

This was the beginning of a hunt for the source of the ventilation problem. Vayanos considered everything from a collapsed lung to a broken Y-piece in the mechanical ventilator. He mentioned or discussed each of these problems. Vayanos performed partial treatments to address some of them or diagnostic tests (eg, listening to breath sounds) to explore them.

The oxygen saturation level continued to drop slowly. By the end of the scenario, Vayanos had partially pursued 8 diagnoses and was still adding candidates to his list as the oxygen saturation dropped into the 80s. Vayanos was among the 44% of the study subjects whose failed problem solving was classified as diagnostic vagabonding, illustrated by jumping from diagnosis to diagnosis.

Why do clinicians fall prey to vagabonding? The self-fulfilling interpretation loop of Figure 1 is again the key to understanding this failure mode. Surprisingly, there is a risk of having interpretation bias be too weak. When the interpretation bias is weak, the clinician tends to prematurely reject a diagnosis—even if correct—in favor of another emerging idea. Alternative diagnoses become erroneously attractive if early evidence is not favorable to the current one.

The adaptive mode: Striking a dynamic balance

What can be done to decrease the likelihood of these diagnostic errors?

1. To avoid biases, clinicians can learn to recognize repeat treatments as a signal of fixation and multiple disconnected actions as a signal of vagabonding.

2. To avoid fixation, clinicians can accelerate generating new cues, hold diagnoses less confidently, or speed up the cultivation of alternatives.

3. To avoid vagabonding, clinicians can stick to treatment algorithms until they are complete, hold diagnoses more confidently, or slow down the cultivation of alternatives.

Fixation error and its cousin confirmation bias have long been seen as the “bad guys” in diagnostic problem solving. The authors’ analysis shows the willingness to “stick with it,” fostered by the self-fulfilling interpretation loop, is, paradoxically, also a boon in diagnostic problem solving. This is the dynamic challenge of diagnosis: while too much bias is harmful (as Dr. Poggioli’s recipe for fixation), too little bias is also problematic (as Dr. Vayanos’ recipe for diagnostic vagabonding).

Using a mathematical model, the authors showed how these diagnostic failure modes as well as the adaptive (ie, successful) mode of diagnosis can emerge by varying only the strength of the interpretation bias. The results show that the adaptive mode of diagnostic problem solving requires striking the right balance between the strength of self-fulfilling interpretation and the pacing of both cultivating alternative diagnoses and gaining access to and interpreting new information. NPSF

References


• Level 4.0: A “presencing” or creatively generative mode. One releases existing mental models and allows a new collective mental model to emerge.

Sharmer believes people spend most of their time listening at levels 1.0 and 2.0. Instead, individuals should spend more time listening at levels 3.0 and 4.0 to work together toward the true potential of an organization.

In the Hawaii collaborative, the state leader deliberately sought opportunities beyond the typical level 1.0 and 2.0 listening modes of traditional learning collaboratives.

**Using the patient-safety definition exercise to foster a 4.0 dialog**

The exploratory exercise of generating 1-word patient-safety definitions opens the door past level 1.0 listening. At a superficial level, this exercise is actually at level 1.0. Participants are being asked to list and confirm their existing definitions. Taking the lists and demonstrating the vast differences among them is a 2.0 exercise. Participants begin to realize some disconfirmation and debate around definitions. Discussing the differences, asking for the stories behind the definitions, and discovering new connections between words is a 3.0 exercise. Asking what might be begins a 4.0 exercise.

The exercise—as unassuming and simple as it might seem—generates vibrant discussion. It has been repeated at a number of board and physician medical executive committee retreats and with multidisciplinary health care audiences. The exercise not only probes what patient safety means at an individual level, but provides environmental and situational context, and ultimately sets the stage for robust 3.0 and 4.0 listening and conversation.

The attention, urgency, and pace of activity around patient safety will continually increase in the months and years to come. Patient safety leaders should not assume that common mental models exist or that all actions should be taken at the national level. Instead, it is critical for teams championing patient safety to take time to understand the complexity and diversity of their individual definitions. Ultimately, this understanding is essential to creating a collective mental model that can pull the organization forward toward a common plan.

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**References**


New Patient Safety Credential Offered

The Certification Board for Professionals in Patient Safety (CBPPS) has announced the official launch of the Certified Professional in Patient Safety (CPPS) exam. This credentialing process is designed to establish patient safety competency standards and elevate the professional stature of health care professionals who meet knowledge requirements in safety science, human factors engineering, and the practice of safe care.

Testing for the CPPS credential will be made available as Patient Safety Awareness Week kicks off globally on March 4, 2012.

Certification requires a combination of education and experience, as well as successful completion of the evidence-based certification exam, which tests candidates on six core patient safety domains: culture, leadership, risk identification and analysis, data management system design, mitigating risk through systems thinking and design and human factors analysis, and external influences on patient safety.

The CPPS credential is recommended for nurses, physicians, pharmacists, other clinicians, health care leadership, patient safety professionals, risk/quality managers, nonclinical health care professionals, client-facing solutions providers, and all others committed to the delivery of safe patient care.

CBPPS has also developed an optional 50-question practice exam, which is parallel in content and difficulty to the actual Certified Professional in Patient Safety exam and is a diagnostic tool to assess candidates’ strengths and weaknesses.

Additional information is available at cbpps.org.

About the Certification Board for Professionals in Patient Safety

The Certification Board for Professionals in Patient Safety (CBPPS) was established by, but is a separate organizational entity from, the National Patient Safety Foundation, and was created to advance, standardize, and promote patient safety knowledge competencies for health care professionals. To this end, successful completion of the rigorously designed Certified Professional in Patient Safety (CPPS) exam attests to candidates’ knowledge of essential patient safety competencies, upon which time the board confers the CPPS credential. Those attaining the CPPS designation represent a group of committed professionals from across health care who are determined to advance the patient safety field and make the health care system safer for all.

Ask Me 3 Video Released

Patient engagement remains a critical untapped lever in the health care environment. In advance of Patient Safety Awareness Week, NPSF has released a new video derived from its Ask Me 3™ program, a patient education program designed to promote communication between health care consumers and providers. The program encourages patients to ask, and understand the answers to, three questions:

- What is my main problem?
- What do I need to do?
- Why is it important for me to do this?

The video is available to the public at no cost. Visit the Ask Me 3 section of the website, www.npsf.org/askme3, or view it on the NPSF YouTube channel at youtu.be/B3EB-icaNKQ.
NPSF Launches CE/CME-Accredited Patient Safety Curriculum

NPSF has introduced a new educational resource for patient safety professionals: the Patient Safety Curriculum. The curriculum is a 10-module, online course intended to equip the learner with the foundational knowledge necessary to understand the context, key principles, and competencies associated with the discipline of patient safety, and how these tenets and skills are applied in everyday practice. The curriculum guides the learner through the history of the patient safety movement, describes the science and disciplines used in this work, presents current best practices, and outlines strategies for overcoming barriers to safe care. The curriculum modules are aligned with educational standards for patient safety competencies and are anchored by didactic audio/PowerPoint lectures given by NPSF board members and members of the Lucian Leape Institute at NPSF. The modules also include videos, reading lists, and quizzes to focus learners on key patient safety principles. The curriculum is designed to provide knowledge imperative for those working in, or in partnership with, the health care system of today.

Continuing Education and Continuing Medical Education Credits are available for participants who complete the 10-module course.

For more information, go to www.npsf.org/curriculum.

Annual Patient Safety Congress Will Highlight Partnership for Patients Initiative

The NPSF Patient Safety Congress brings together patient safety experts and practitioners from around the globe in a program designed to provide real-world tools, resources, and evidence-based solutions for patient safety issues.

The program offers 30 educational sessions led by industry experts, along with a full day of in-depth Pre-Congress sessions and a variety of inspirational plenary presentations.

The 2012 NPSF Patient Safety Congress will celebrate the 1-year anniversary of the groundbreaking Partnership for Patients Initiative. Dedicated sessions will showcase Partnership for Patients accomplishments, the role of consumers and patient advocates, and discussion of wider opportunities for community engagement in health care and patient safety.

Find out more information, view a preliminary schedule of breakout sessions, and register online at npsfcongress.org/.