Diagnostic Error

The Next Organizational Challenge: Finding and Addressing Diagnostic Error

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Now more than a decade old, the patient safety movement is emerging from its early beginnings and appears poised to significantly improve patient care. Four landmark reports from The Institute of Medicine outlined a pathway to safer care that centered on finding and addressing the inherent flaws in our health care systems.1–4 With clear pressure to show progress, health care organizations (HCOs), including hospitals, have tackled a wide range of patient safety concerns in this domain, with the goal of reducing harm from problems such as falls, health care–associated infections, medication errors, and “never events” such as wrong-site surgery. In some areas, these efforts are starting to improve patient outcomes.5

Although HCOs are intensely focused on improving the safety of health care, efforts to date have almost exclusively targeted treatment-related issues; few are focused on diagnostic error.6,7 Of the current metrics used to evaluate health care quality, none target diagnostic error.8 Achieving the highest possible levels of quality will require a more balanced approach, in which the reliability of diagnosis receives equal attention. To quote form the vision statement of the recently formed Society to Improve Diagnosis in Medicine, diagnosis “needs to be accurate, timely, efficient, and above all, safe.”9

In this article, we review why HCO leaders need to be concerned about diagnostic error. We argue that a major reason that diagnostic error has remained in the shadows relates to the difficulty in finding these errors. We review the available literature relating to this problem, concluding that the existing tools health care organizations use to capture adverse medical events are insensitive for detecting diagnostic errors. Several novel approaches have recently been considered and trialed that offer strategies to detect diagnostic error, of which two are described.

Why Health Care Organizations Need To Get Involved

HCOs are preoccupied with a large number of quality- and safety-related operational and clinical issues, including perfor-

Article-at-a-Glance

Background: Although HCOs are intensely focused on improving the safety of health care, efforts to date have almost exclusively targeted treatment-related issues. The literature confirms that the approaches that HCOs use to identify adverse medical events are not effective in finding diagnostic errors, so the initial challenge is to identify cases of diagnostic errors.

Why Health Care Organizations Need To Get Involved: HCOs are preoccupied with many quality- and safety-related operational and clinical issues, including performance measures. The case for paying attention to diagnostic errors, however, is based on the following four points: (1) diagnostic errors are common and harmful, (2) high-quality health care requires high-quality diagnosis; (3) diagnostic errors are costly; and (4) health care organizations are well positioned to lead the way in reducing diagnostic error.

Finding Diagnostic Errors: Current approaches to identifying diagnostic errors, such as occurrence screens, incident reports, autopsy, and peer review, were not designed to detect diagnostic issues (or problems of omission in general) and/or rely on voluntary reporting. The realization that the existing tools are inadequate has spurred efforts to identify novel tools that could be used to discover diagnostic errors or breakdowns in the diagnostic process that are associated with errors. New approaches—Maine Medical Center’s case-finding of diagnostic errors by facilitating direct reports from physicians and Kaiser Permanente’s electronic health record–based reports that detect process breakdowns in the follow-up of abnormal findings—are described in case studies.

Conclusion: By raising awareness and implementing targeted programs that address diagnostic error, organizations may begin to play an important role in addressing the problem of diagnostic error.
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1. Diagnostic Errors Are Common and Harmful. Diagnostic errors represent a critical and unsolved problem in health care today, a problem with substantial clinical and financial impact. One estimate places the annual death toll from these errors in the United States at 40,000–80,000 per year,\(^{10}\) with an estimated 36,000 preventable deaths from diagnostic error arising in the ICU alone.\(^ {11}\) One patient in three can describe a diagnostic error that has personally affected him or her, and his or her family or immediate circle of friends, and more than half of pediatricians report encountering one or more diagnostic errors every month.\(^ {13}\) At least one in every thousand primary care encounters will cause preventable harm from diagnostic error.\(^ {14}\) These estimates translate to one case of error-related harm every day in the ambulatory care setting,\(^ {14,15}\) and 10 deaths per year in the typical hospital,\(^ {10}\) (Figure 1, above, right). In 2011 the American Medical Association (AMA) called attention to this dilemma, including the need for research to identify more appropriate ways to find and count these errors.\(^ {16}\) The AMA report, which summarized research and initiatives on patient safety in ambulatory settings during the previous decade, concluded that we have made insufficient progress in understanding and improving ambulatory patient safety. Diagnostic errors take on special significance in this context, because they are the most among the most frequent, harmful, and costly types of errors in this setting.

2. High-Quality Health Care Requires High-Quality Diagnosis. Reliability of the diagnostic process is now recognized as a prerequisite for high-quality care.\(^ {8}\) During the next few years, this issue will receive increasing attention from safety organizations, oversight agencies, and patients themselves. In 2005 The Joint Commission initiated this process through its National Patient Safety Goal regarding the reliable communication of critical test results.\(^ {7}\) This will likely be just the first of additional steps devoted to improving the reliability of the diagnostic process, aptly referred to as the “next frontier” in patient safety.\(^ {18,19}\)

3. Diagnostic Errors are Costly. Besides detracting from quality care and patient satisfaction, diagnostic errors also generate substantial costs for HCOs. The most visible components are the direct costs of defending and resolving malpractice claims. In many disciplines, including medicine, pediatrics, and emergency medicine, the largest fraction of paid claims relate to missed or delayed diagnosis.\(^ {20}\) These claims are the most difficult to defend and involve the largest payouts. Less obvious but possibly of equal or greater magnitude are the costs related to diagnostic inefficiency, including over- and under-testing, and ordering tests that are inappropriate or of low value. The Choosing Wisely campaign recently launched by Consumer Reports and the ABIM Foundation represents a first step towards reducing these costs, but a great deal of additional attention and oversight is needed.\(^ {21}\) In addition, diagnostic errors contribute to hospital readmissions, costs that could potentially be avoided if the correct diagnosis is made during the initial hospital stay. Finally, unwarranted treatments, given for wrong diagnoses that patients do not actually have, are another source of unnecessary costs associated with diagnostic error.

4. Health Care Organizations Are Well Positioned to Lead the Way in Reducing Diagnostic Error. It would be appropriate for physicians to address the problem of diagnostic error as their own professional responsibility. Unfortunately, the problem is too complex and the diagnostic process too intertwined with the

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* NPSG.02.03.01. Report critical results of tests and diagnostic procedures on a timely basis. Element of Performance 1. Develop written procedures for managing the critical results of tests and diagnostic procedures that address the following: The definition of critical results of tests and diagnostic procedures; by whom and to whom critical results of tests and diagnostic procedures are reported; and the acceptable length of time between the availability and reporting of critical results of tests and diagnostic procedures.
particular health care system for this to be a realistic expectation. Making progress will require a commitment from all stakeholders, in this case physicians, patients, medical educators, and health care leaders working together in a coordinated fashion. Importantly, diagnostic errors cannot be reduced without the HCO leadership recognizing the problem, giving it priority among the many other competing demands for health care resources and taking active steps to understand diagnostic errors and support interventions to help reduce the risk of error.

**Finding Diagnostic Errors: Existing Methods**
Research data on diagnostic errors exist—but not data on actual practices used to find them. A wide range of research approaches have been used to study the incidence of diagnostic error, including autopsies, patient and provider surveys, chart studies of particular diseases, closed claims reviews, second reviews (for example, a second pathologist reviews the impressions of the first pathologist), and sending standardized patients into practice settings. These studies, as diverse as they are, consistently find that the incidence of diagnostic error is unacceptably high, generally in the range of 10%–50%.22

What’s missing is data from actual practice to confirm these estimates from research investigations. To the best of our knowledge, there is not a single HCO in the United States that is systematically measuring the rate of diagnostic error in its clinics, hospitals, or emergency departments. Because there are no local data, there are also no national data. The most fundamental axiom of improvement is that it requires data, and the absence of data on diagnostic errors is a critical reason that this problem persists and may be growing.

Why are diagnostic errors so hard to find? At a time when hospitals are collecting data on literally hundreds of process and outcome measures, the absence of data on misdiagnosis in everyday practice is striking, yet understandable—HCOs don’t know how to identify these errors, the first step in measurement. Health care organizations use an ever-expanding armamentarium of tools to find adverse medical events, as summarized in Table 1 (above).22 Although these tools work well in identifying incidents such as medication errors, falls, and the various never events, they generally fail to detect diagnostic errors. The two major weaknesses of these tools in regard to finding diagnostic errors are that they (1) were never designed to detect diagnostic issues (or problems of omission in general)—as is the case, for example, with the Global Trigger Tool,23 and (2) rely on voluntary reporting. Physicians regularly identify diagnostic errors; they just don’t take the time to report them or they are concerned that these reports will cause harm to themselves or colleagues.24

In a survey reported in 2008, 86% of the hospitals reported that physicians reported few or no medical errors.25 Similarly, in a study reported in 2010, which examined five different incident-detecting tools in use at a single institution, physicians contributed just 2.5% of adverse event reports reported.26
Random chart reviews overcome the problem of reporting bias, but they are expensive, limiting their feasibility. In addition, they have a low yield for detecting diagnostic errors—probably less than 1%.14,27 Even in cases in which there is a definite diagnostic error, it may not be evident solely from review of the medical record.28,29

In summary, there is ample evidence that, separately and even in aggregate, the existing tools are ineffective in discovering diagnostic errors. Confirming this impression, Tsang and coworkers recently reviewed the utility of various current detection tools to identify diagnostic errors in ambulatory settings, concluding that none were helpful.30 Similar findings are obtained from reviews of inpatient care. A recent study from the Office of the Inspector General used five different tools to study adverse events involving 785 hospitalized Medicare beneficiaries. The study identified a 13% incidence of adverse events of various types, but none of these were categorized as related to diagnostic error.31

Finding Diagnostic Error: Newer Approaches
The growing interest in diagnostic errors, coinciding with the realization that the existing tools are inadequate, has spurred efforts to identify novel tools for discovery of diagnostic errors or breakdowns in the diagnostic process that are associated with errors. Two pioneering health care organizations have responded to this challenge. Maine Medical Center has pioneered case-finding of diagnostic errors by facilitating direct reports from physicians, and Kaiser Permanente has created sophisticated yet practical electronic health record (EHR)–based reports that detect process breakdowns in the follow-up of abnormal findings. These approaches are now described in case studies.

CASE STUDY 1. MAINE MEDICAL CENTER: FACILITATING PHYSICIAN REPORTING

Background: To become learning organizations, institutions need to seek out, analyze, and understand the causes of diagnostic errors locally. There is no better lesson than learning from your own mistakes, and measurement is what will drive action. With autopsies disappearing, these efforts can help restore the powerful impact of errando descimus—learning from one’s own mistakes.

Methods: In 2010, Maine Medical Center (Portland, Maine), a 605-bed independent academic medical center affiliated with Tufts University School of Medicine, initiated a multimodality program to increase the visibility of diagnostic errors within the institution and develop a robust response to identified errors. The three-pronged program, which was endorsed by local physician champions and supported by leadership, consisted of three successive comments: an educational campaign, a physician-based reporting system, and a redesigned method for root cause analysis (RCA) for cases involving diagnostic error.

The six-month educational campaign was designed to emphasize the shortcomings of the diagnostic process and the significant impact of diagnostic error on patient outcomes. Didactic sessions were held for all of the major departments, including faculty, residents, and students. Departmental residency-based Morbidity and Mortality Conferences were redesigned to reflect a specific emphasis on diagnostic error. Teaching avoidance of diagnostic error by improving clinical reasoning skills became regular topics in faculty development programs. By the end of the initiative, the majority of the medical staff had the opportunity to attend a session introducing them to the concept of diagnostic error and the prevalence and importance of such errors as well as common causes and potential solutions.

Despite this educational campaign, Maine Medical Center struggled to identify diagnostic errors, and, consequently, created a diagnostic error reporting system32 to facilitate reporting of diagnostic errors by clinicians in real time. This open and anonymous system, which required input of a minimal amount of information (patient medical record number, type of error, a brief description of the error, and degree of patient harm incurred), was available on all clinical workstations, although the pilot was limited to the adult inpatient medical services. Reporting was further encouraged by a hospitalist peer who championed the program. Reported incidents were reviewed by physicians with expertise in diagnostic error to verify the presence of a diagnostic error.

A second and simultaneous innovation involved creating a novel process for RCA of the reported cases of diagnostic error as part of the institutional peer review program. The RCA addressed both cognition- and systems-based contributions, which also served to increase physician interest and participation in the review process. This RCA fishbone was based on the diagnostic error classification system suggested by Graber et al33 and the Diagnostic Error Evaluation and Research form designed by Schiff et al.34 and incorporated the common root causes of diagnostic error.35 RCA sessions involved clinicians, including those with expertise in diagnostic error, and department heads.

Results: During a trial and evaluation period from January through June 2011, 80%–90% of reported diagnostic errors were confirmed. The initial six-month pilot of the system revealed 36 diagnostic errors that otherwise would have been unreported. The severity of errors uncovered was high, with 51% incurring moderate harm to the patient and 22% serious harm.
The diagnoses associated with diagnostic errors were concordant with those reported in previous series, with the most commonly reported diagnoses being epidural abscess/hematoma, acute coronary syndrome, and stroke.

The redesigned RCA process had both immediate and significant impact. Because the process emphasized both clinician-based and system-based factors, physicians were remarkably engaged in the review process, as previously described in a similar program. Whereas previously it was difficult to secure the attendance of one or two physicians at the four-hour RCA sessions, with the redesigned system, six or more physicians would participate. More importantly, the novel fishbone diagram facilitated appreciation of the complexity of these errors. These discussions led directly to the design and implementation of interventions designed specifically to address the causes of these errors. The interventions included an institutional consultation protocol, several departmental initiatives designed to address affective bias (in which emotions affect diagnosis), and construction of symptom-specific diagnostic pathways for several common presenting complaints.

Discussion and Lessons Learned: The educational campaign, physician-based reporting system, and redesigned RCA method promoted increased awareness of diagnostic error for clinicians, risk management staff, and hospital leadership. The identification and analysis of local errors provided a strong impetus for addressing identified latent system flaws.

Although successfully implemented, the program was resource intensive and required significant effort to develop and maintain, and its long-term sustainability and actual effect on diagnostic reliability are unclear. Limitations include the debatable effect of continued education, the significant and ongoing effort required to encourage physicians to input these errors, and the challenge of not only identifying the underlying causes of errors but also in developing and implementing meaningful interventions.

Case Study 2. Kaiser Permanente: Leveraging the Electronic Health Record to Find Diagnostic Errors

Background: Efforts to enhance the reliability of the diagnostic process are occurring across the eight regions of the integrated health care delivery system Kaiser Permanente. These efforts are coordinated by the Diagnostic Reliability Improvement Initiative, a multidisciplinary team of individuals who have access to the organization's database of adverse events. This allows prioritization of improvement initiatives on the basis of the frequency and severity of various types of harm as reflected in the database.

Sidebar 1. Key Principles in Creating Efficient Safety Nets in the Kaiser Permanente System*

- Reliance on administrative data to screen for failure to follow up, as manual review would not be scalable for the large volumes of testing done in a region of more than 3.5 million members. Some safety nets rely on a combination of administrative data and manual review (for example, PSA safety net). Others are purely automated and do not require any manual intervention (for example, sending out notifications to patients if they fail to obtain laboratory tests within 30 days of the order). Other safety nets require some physician action, with the rest automated (for example, electronically pending orders for appropriate laboratory testing for patient on chronic medication, which, on physician signature, generates automated letters to the patients informing them to go to the laboratory for follow-up tests).
- Buy-in from the clinicians involved in the care of the patient to intervene on their behalf when appropriate with interventions that can be done largely by a centralized safety net team.
- A system to track the effectiveness of each safety net created, allowing assessment of efficacy of the program and further learning.
- Method(s) for identifying potential types of diagnostic errors to be addressed, including: malpractice claims, published literature on known hazards, suggestions from frontline physicians, certain HEDIS® metrics, various chiefs of service groups, risk management, and opinions of expert physician quality leaders.
- Rapid implementation of new safety nets, thereby enhancing credibility among frontline physicians when problems are identified regarding centralized programs to promote a safe culture. This encourages physicians to propose new safety nets.

* PSA, prostate-specific antigen; HEDIS® Healthcare Effectiveness Data and Information Set (NCQA, Washington, DC).

One of the major initiatives addressing diagnostic error is the Safety Net program developed by the Southern California Region of Kaiser Permanente (SCAL KP) in ___. Each safety net targets a ___________________________. The key principles in creating efficient safety nets are listed in Sidebar 1 (above). The safety nets leverage the EHR implemented across KP–KPHC-Kaiser Permanente Health Connect, which is based on a commercially available system, to enable centralized monitoring, detection, and outreach regarding a wide variety of patient safety issues. An important feature of the Safety Net program is that it is designed to catch errors before harm reaches the patient, so that mitigation is still possible. It does not prevent errors or lapses in care from occurring in the first place, and is not 100% effective in preventing harm in all patients it catches. Since its implementation in ____, the SCAL KP outpatient Safety Net program has identified 4,925,145 outpatient safety hazards and facilitated and completed 2,167,064 successful interventions (alerts to primary care providers) for 2,167,064 of them. A key
concept is that even a very low incidence of error, such as failure to follow up abnormal test results, can affect a large number of patients in a system as large as SCAL KP, which has 3.6 million members. Of the 19 safety nets currently implemented, 10 are relevant for safe and timely diagnosis, as shown in Table 2 (above), which details the impact realized from each of these measures.

An illustrative example of the Safety Net program in operation is the module addressing colorectal cancer (CRC). Although its rates of colorectal cancer screening are among the highest in the United States, KP members continue to present with advanced stage colorectal cancer. Common causes of presentation at advanced stages of CRC include lack of screening, falsely negative screening tests, delay or failure to evaluate early symptoms of CRC, and lack of follow-up or evaluation of abnormal test results. In 2010–2011, 61 of the 3.6 million patients presented with stage III or IV CRC, and opportunities for earlier intervention were identified for 47 of those patients, as follows:

- 11 patients experienced rectal bleeding, which was falsely attributed to hemorrhoids for two months to several years before the diagnosis of CRC was established.
- 5 patients had iron-deficiency anemia identified previously without a gastrointestinal workup.
- 2 patients had positive immunological fecal occult blood tests (iFOBT) that was not further evaluated by colonoscopy within one year.
- 17 patients had not undergone CRC screening by any modality.
- 12 patients had presumed false-negative CRC screening (4 by iFOBT, 3 by sigmoidoscopy, and 6 by colonoscopy) during a period of up to seven years before the diagnosis of advanced stage CRC.

Methods: Two Safety Nets were developed using electronic screens to detect cases of patients with rectal bleeding (Internat-

| Table 2. Safety Nets Operating to Prevent Diagnostic Errors in the Kaiser Permanente Health Care System* |
|-------------------------------------------------|-----------------------------------------------------------------------------------|
| Positive prostate-specific antigen tests         | Between April 2006 and December 2009, 8,076 patients fell into the safety net, of whom 3,833 received urology appointments, 2,204 patients underwent prostate biopsy, resulting in diagnosis of prostate cancer in 745 patients. |
| Positive fecal occult blood testing              | Continuous tracking of every positive result until colonoscopy performed or documented patient refusal or physician decision that follow-up is not indicated. |
| Abnormal Pap smear follow-up                     | Continuous tracking of every positive result until follow up performed or documented patient refusal or physician decision that follow-up is not indicated. |
| Overdue labs (labs ordered but not completed within 30 days) | June 2010 to 2012: 1.2 million overdue labs identified and orders placed, yielding 244,468 patients with labs repeated. |
| Post splenectomy state without proper immunizations | 267 patients identified through Natural Language Processing; 696 identified through administrative data. 160 patients fully vaccinated in the first 90 days |
| Medication monitoring for patients on digoxin (K+ and creatinine) | From 2009–2011, 2,429 patients identified with missing labs and orders placed, yielding 1,391 patients with labs repeated and 180 with abnormal lab results |
| Medication monitoring for patients on anticonvulsants | From 2010–2011 10,210 patients identified with missing labs and orders placed, yielding 4,242 patients with labs repeated and 1,730 with abnormal lab results |
| Medication monitoring for patients on ACEs/ARBs & diuretics (Na+, K+, creatinine) | From 2010–2011, 256,000 patients identified with missing labs and orders placed, yielding 131,494 patients with labs repeated and 20,409 with abnormal lab results |
| Abnormal creatinine that is not repeated         | From 2009–2011, 5324 patients identified with an abnormal creatinine not repeated and lab orders placed, yielding 2,565 patients with labs repeated (48%) and 1,078 new cases of CKD identified. |
| Colon cancer (microcytic anemia or rectal bleeding in patients who should have a colonoscopy but did not) | 187 patients with iron deficiency were referred for colonoscopy; 48 patients had the procedure, identifying the diagnosis in 20. 102 patients with rectal bleeding were referred for colonoscopy; 26 had the procedure, identifying the diagnosis in 20, including 1 case of colorectal cancer. |
| Hepatitis C positive screening tests without a confirmatory test performed | Between Jan 2010 and July 2012, 614 patients identified and orders for confirmatory testing pending |

* CKD, chronic kidney disease.
tional Classification of Diseases, Ninth Revision (ICD-9) codes 569.3x and 455.xx) and/or possible iron deficiency anemia (based on microcytosis, normal renal function, and hemoglobin < 14 g/dl and red cell count < 4.7M/microliter (males) or hemoglobin < 12 g/dl and red blood count (RBC) < 4.2M/microliter [females]) without documented subsequent follow-up. Screen fallouts were reviewed by a gastroenterologist, who, if appropriate, sent a message to the primary care physician which suggested a colonoscopy. After several weeks, a clerk checked the records to see if there was any follow-up. If not, the gastroenterologist then sent a second note, which now went into the medical record. At either step, if the primary care physician documented that he or she evaluated the case and that the patient did not need further evaluation, the case was closed.

Results: Some 168 outpatients 55–75 years of age with rectal bleeding who did not have subsequent colonoscopy were identified between April 2, 2010 and May 31, 2012. Of the 102 patients referred for colonoscopy, 26 completed the procedure—one patient had an adenocarcinoma with spread to a local lymph node, 1 had a carcinoid tumor, 7 had one or more tubular adenomas, 3 had one or more hyperplastic polyps, 7 had hemorrhoids, and 1 had colitis. Of the 76 patients who did not receive a colonoscopy, 33 failed to respond to three attempts at contact, and 24 patients refused the procedure.

For the November 11, 2010–July 31, 2012 period, we identified 366 outpatients 55–75 years of age with presumed iron-deficiency anemia and no subsequent colonoscopy, of whom 187 patients were referred after gastroenterologist review for colonoscopy. Of the 187 patients, 48 patients had a colonoscopy, and 139 patients had not.

Discussion and Lessons Learned: The Safety Net program establishes a new approach to identify opportunities to improve the quality of the diagnostic process and avoid diagnostic errors. Analysis of cases of late-stage presentation of cancer can help health care systems determine why such cases occur and design interventions to facilitate diagnosis at an earlier stage. Moreover, two identified diagnostic errors—failure to work up rectal bleeding and failure to rule out colon cancer in patients with suspected iron deficiency anemia—are errors amenable to mitigation using a semiautomated algorithm for selected case reviews.

Detection strategies (“trigger tools”) leveraging the EHR (“trigger tools”) are also being developed and tested in the US Department of Veterans Affairs System. In one such approach, data-mining algorithms were applied to outpatient records at two medical centers to identify patients lacking appropriate follow-up for abnormal prostate-specific antigen (PSA) test results or conditions associated with colorectal cancer (positive fecal occult blood, hematochezia, or iron-deficiency anemia). Murphy et al. estimated that the approach would identify more than a thousand instances of delayed or missed follow-up of these abnormalities during a one-year period, with identification of 47 high-grade cancers. Singh et al. have also developed algorithms that identify patients at high risk for diagnostic error, such as patients with a nonelective inpatient admission within two weeks of a primary care index visit. Diagnostic errors could be identified from the medical record in about 20% of such cases, compared with 2% in randomly selected clinic charts. The algorithm-triggered cases provide unique and important insights into the causes for these errors by identifying “missed opportunities” in the diagnostic process. Being able to find such cases and analyze the root causes for these breakdowns isolates the areas that need improvement.

Discussion
HCOs should take an active role in addressing the problem of diagnostic error to provide high-quality care, with the initial challenge being to begin identifying diagnostic errors in routine practice. Using facilitated physician reporting (Maine Medical Center) or EHR-based triggers to identify diagnostic errors that have already occurred (Department of Veterans Affairs), or identifying missed opportunities related to diagnosis that can still be remediated (Kaiser Permanente) all represent novel and effective approaches to accomplish this.

An additional option for identifying diagnostic errors is to simply ask the patient if he or she has been misdiagnosed. Patients recently seen in the emergency department or discharged from the hospital would be ideal populations to target. In a recent survey, three in five respondents were “very” or “extremely” concerned about diagnostic errors, and apprehension about diagnostic errors is the chief concern of patients seen in an emergency setting. Patients are able, willing, and motivated to participate in error-reporting systems. A Canadian study of families who had experienced a pediatric hospital admission identified a wide range of safety concerns, almost none of which (fewer than 3%) had been identified by the hospitals’ own safety-monitoring programs. Similar findings have been reported from Japan, Sweden, and the United States. Weissman et al. reported a study of 998 recently discharged inpatients in Massachusetts, who identified twice as many adverse events as did trained staff who reviewed their medical records. In a related study, interviews of 228 inpatients during their admission and within 10 days of discharge identified 20 adverse events and 13 near misses, none of which had been identified through the tra-
opportunistic incident reporting pathways. Patients are also able to report diagnostic errors in ambulatory settings; a survey of primary care patients found that 13% had experienced a diagnostic error. The National Patient Safety Foundation and the American Hospital Association have endorsed and campaigned for patient participation to prevent medical errors, and the Agency for Healthcare Research and Quality is currently developing a national, voluntary reporting system for patients.

**BEYOND DETECTION STRATEGIES: EDUCATIONAL OPPORTUNITIES TO IMPROVE DIAGNOSIS**

Detecting diagnostic errors is just the first step in reducing the likelihood of harm from diagnostic error. As outlined in Sidebar 2 (right), HCOs can take concrete steps to raise awareness of the problem and reduce the risk of diagnostic error. For example, The University of Pennsylvania Health System and the Perelman School of Medicine (Philadelphia) have embarked on such a program. At the organizational level, workshops jointly sponsored by the chief medical officer and General Counsel included discussion of diagnostic errors on the basis of aggregated errors during the previous five years, and strategies to address these errors were proposed. Concepts relating to diagnostic error were also added into the patient safety curriculum. Medical students now all receive an introduction to decision making and cognitive error in their first year, and these concepts are revisited and reinforced during a differential diagnosis course in which clinical decision making is emphasized. In parallel, a unique longitudinal curriculum on diagnostic error was introduced into the internal medicine residency program alongside a new curriculum on high-value care. The curriculum presented methods to teach and differentiate cognitive errors from systems errors; and provided instruction on heuristics, bias, and the dual process paradigm; interactive, case-based activities using small-group facilitation and video vignettes; and a reflective exercise in which residents write and reflect on a diagnostic error with cognitive components that they have experienced. Residents participating in the program improved their ability to identify cognitive bias when presented with written clinical cases or video vignettes in which cognitive errors were present and were able to easily recall, reflect on, and openly discuss diagnostic error in their practice.

**Conclusion**

Leaders of HCOs are realizing that improving patient safety is a major challenge, and reducing diagnostic error is the next imperative in this quest. The substantial harm and costs associated with diagnostic error are formidable motivating factors for HCOs’ involvement. By raising awareness and implementing targeted programs that address diagnostic error, organizations may begin to play an important role.

**Sidebar 2. Interventions to Raise Awareness of Diagnostic Error and Interventions to Reduce the Risk of Diagnostic Error**

**Raise Awareness**

- Develop a dashboard to monitor diagnostic error: number of cases detected per year; number of root cause analyses performed; and number of improvement projects started.
- Follow up with patients seen in the emergency department to determine if the diagnosis provided was correct.
- Institute a peer review program to monitor the quality of pathology and radiology diagnoses.
- Monitor preanalytic, analytic, and postanalytic errors from the clinical laboratory.
- Develop feedback pathways so that providers learn about changes in a patient’s diagnosis and diagnostic errors.

**Reduce the Risk of Error**

- Make sure that all critical medical imaging studies are read in real time by a radiologist.
- Ensure subspecialty expertise is available when needed.
- Use a certified electronic health record.
- Use tools to promote differential diagnosis (for example, checklists; web-based tools that suggest a differential diagnosis based on the key features of the case).
- Facilitate patients’ obtaining a second opinion.
- Improve communication amongst providers.
- Ensure that all ordered tests, consults, and procedures are completed.
- Ensure that patients receive the results of the diagnostic tests.
- Ensure that patients receive appropriate cancer screenings.
- Ensure that all patients receiving a diagnosis know when and how to come back for re-evaluation if their symptoms persist or change.
- Improve the environment for diagnosis: Allow enough time, minimize distractions, reward diagnostic quality.
- Promote a culture of safety and open dialogue. “I’m not sure”; “I need help”; “I need a second opinion”; and “not yet diagnosed” (NYD) should be heard more commonly. NYD should be used in documenting impressions of patients in whom the diagnosis is not highly certain.

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The Joint Commission Journal on Quality and Patient Safety

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March 2014 Volume 40 Number 3

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