

ED Legal Letter™

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Achilles heels of the ED: Delayed or missed diagnoses

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Editor's note: Historically, ED Legal Letter has evaluated the mistakes of physicians after the fact. The diagnosis has been missed, the case has been litigated and decided. The benefit of hindsight provides an essential learning and risk management opportunity for the reader. This month's issue will evaluate the thinking and behavior of physicians that lead to errors in diagnosis. An analysis of the cognitive errors in the ED by physicians will provide reflection on future premature or inaccurate diagnosis in the ED. This issue will allow physicians to recognize that certain types of thinking and behavior can be harmful to the patient. Acknowledging these faults will reduce bad outcomes and prevent future litigation.

Introduction

A first-year resident assesses a pleasant elderly woman who slipped and injured her ankle the previous day. She was able to bear weight immediately following the fall, but her daughter tells the resident she has been limping since. There is no bony tenderness or any significant swelling around the ankle malleoli or foot, and the resident concludes that the patient does not require x-ray. He makes a diagnosis of ankle sprain and reviews the case with his attending physician. Following an examination of the patient, the attending physician makes a diagnosis of ruptured Achilles tendon. The resident has just experienced a problem that will pervade his future career in emergency medicine. Approximately half of all litigation that will be brought against him and his colleagues will be for delayed or missed diagnosis.¹ Unfortunately, many of the missed diagnoses will be of more consequence, and will include missed myocardial infarction,

subarachnoid hemorrhage, aortic dissection, pulmonary embolus, meningitis, bowel infarcts, ectopic pregnancy, and others, some of which will have a permanently disabling or fatal outcomes.

Why Do We Make Diagnostic Errors?

Establishing a diagnosis is the most critical aspect of an emergency physician's function. It provides the essential zeitgeist for much of the goal-directed activity of physicians in the ED, but is also the incubus that comes to haunt them. The process begins with a review of the presenting complaint, and physical examination. Where indicated, a systems review, review of past medical history, and ordering of various tests is included. The essential overlay of this process is the physicians's thinking. It guides the multiple decisions that will be required at every stage toward arriving at a diagnosis. When the diagnosis is wrong, something is clearly amiss in the physician's

thinking. Therefore, we need to know as much as possible about how physicians think and make decisions in the ED. Importantly, we need to understand failures in thinking in the ED and the cognitive errors that lead to delayed or missed diagnoses.

What is there to guide us on the thinking behavior of emergency physicians? There is an abundant literature on clinical decision making in medicine, and various models have been proposed to describe the process by which diagnoses are made.

But for the ED, such models suffer from three major drawbacks. The first is an assumption that decisions are made under optimal conditions, by rational beings, who understand and apply principles of probability theory.² The second is that such models do not take into account the prevailing intrinsic and systemic error-producing conditions (EPCs) in most EDs, or violation-producing behaviors (VPBs) of clinical staff (see **Table 1**), that typically confuse and confound this approach.^{3,4} The third is that there is an incomplete appreciation of the widespread use of heuristics, the abbreviated shortcuts that permeate ED decision making.⁵ Many heuristics are driven by a cognitive disposition to respond (CDR) to a particular patient, in a particular situation.^{6,7} They are a necessary feature in this setting; but, in some cases, will prove insufficient for the task. When they fail, the outcome may be catastrophic. The influence of such CDRs, biases, and failed heuristics is beginning to enter medical decision-making models,⁸ and a recent catalogue has been published both for the ED setting⁶ and for the general domain of medicine.⁷

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Questions & Comments

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Systematic Approaches to Diagnostic Error

Graber, et al. have recently provided a systematic framework for approaching diagnostic error.⁹ They delineate three sources of error: no-fault, system related and cognitive. Table 2 gives examples of each in the context of the ED.

The no-fault errors that are described certainly provide some exculpation for the emergency physician, but clinical acumen often should prevent these errors being made. For example, repeated experience with malingers, and those with factitious or somatization disorders, often will result in their detection and appropriate diagnosis. History taking is a critical prerequisite to making a correct diagnosis and clinicians always should satisfy themselves that they have performed this part of the assessment adequately. No

doubt, experienced clinicians will have their antennae raised for the possibility of unreliable information from the patient, but there are limits to the degree of suspicion and skepticism. All patients need to be given the benefit of any doubt.

Many errors that arise in the systemic category often are not under the control of the emergency physician. The microsystem of the ED is continuously compromised by systemic failings and, unfortunately, many clinicians and nurses come to live with them, resulting in “normalization of deviance.” Nevertheless, the effort to correct these deficiencies should be sustained.

Cognitive errors remain, perhaps, the most critical of the categories. There are considerable aids now available to lessen knowledge deficiencies (e.g., hand-held computers), thus physicians need to rely less upon memory. However, inadequate information gathering cannot be excused. The prevailing impediments in this category are the known CDRs referred to above. The major CDRs that give rise to cognitive error are listed in the **Insert**.

A working knowledge of them provides both a lexicon and a means for categorization and analyzing diagnostic error in the ED. These terms should become part of the ED physician’s language and thinking. In the following cases, they will be used to illustrate how clinicians arrive at the wrong diagnoses. This retrospective process suffers a major limitation in that thinking errors are largely covert, and some interpolation is required to infer what the physician was thinking in arriving at a particular diagnosis or course of action. Also, it rarely is possible to fully appreciate the subtle cues and ambient conditions that prevailed at the time the diagnosis was made. These may have a significant impact on thinking, and often are not fully appreciated.

Case No. 1: Calcaneal Fracture

*Braun et al. v. Rycyna.*¹⁰ On Aug. 4, 1979, James Braun fell 15 feet from a ladder, landing on a concrete surface. He was seen at an ED where x-rays were taken of both ankles, and the emergency physician diagnosed a fracture of the right ankle. He was referred to an orthopedic specialist, who applied a walking cast. No additional x-rays were taken.

Approximately six weeks later, the cast was removed, and an x-ray of the right ankle showed the fracture to be healed. Despite Braun complaining of

Table 1. Characteristics of the ED and Personnel that May Lead to Diagnostic Error

ERROR-PRODUCING CONDITIONS (EPCS)

- **Intrinsic**
 - Cognitive disposition to respond (CDRs)
 - High levels of diagnostic uncertainty
 - High decision density
 - High cognitive load
 - Multiple transitions of care
 - Multiple interruptions/distractions
 - Low signal to noise ratio*
 - Surge phenomena*
 - Circadian dysynchronicity
 - Fatigue
 - Novel or infrequently occurring conditions
- **Systemic**
 - High communication load
 - Overcrowding
 - Production pressures
 - Narrow time windows
 - High noise levels
 - Inadequate staffing
 - Poor feedback
 - Inexperience
 - Inadequate supervision
 - RACQITO*
- **Violation-Producing Behaviors (VPBs)**
 - Gender*
 - Risk-taking behavior
 - Normalization of deviance
 - Maladaptive group pressures
 - Maladaptive copying behavior
 - Underconfidence
 - Overconfidence
 - Maladaptive decision styles
 - Authority gradient effects
 - Likelihood of detection

***Key: Low signal-to-noise ratio** = the low likelihood of a critical diagnosis compared with a benign diagnosis for similarly presenting symptoms and findings; **Surge phenomena** = rapid changes in volume and acuity, routinely experienced in many EDs; **RACQITO** = Resource Availability Continuous Quality Improvement Trade-Off, refers to general systemic overload, where limitations in resource availability within the ED and hospital produce trade-offs against quality decision making; **Gender** = an increased likelihood of violation-producing behavior in males compared with females that has been described in other settings.

Source: Adapted from Croskerry P, Sinclair D. Emergency medicine — A Practice Prone to Error? *CJEM* 2001;3:271-276, and Croskerry P, Wears RL. Safety Errors in Emergency Medicine. In: Markovchick VJ, Pons PD, eds. *Emergency Medicine Secrets*. 3rd ed. Philadelphia: Hanley & Belfus; 2003, pp. 29-37.

Table 2. Diagnostic Failure Categories in the Emergency Department

NO FAULT

- Unreliable information from patient
- Deliberate misrepresentation of illness (malingering)
- Somatization disorder
- Factitious disorder
- Insufficient medical information available about a new disease
- Patient refusal of critical diagnostic tests/procedures/consultation
- Silent presentation of comorbid disease

SYSTEMIC

- Error-producing conditions (EPCs)
- RACQITO*
- Laboratory error
- Inefficient follow-up of reports
- Time delays
- Unavailability of services
- Poor patient follow-up

COGNITIVE

- Cognitive disposition to respond (CDRs)
- Violation-producing behaviors (VPBs)
- Knowledge deficiencies
- Incomplete data gathering
- Test misinterpretation

***Key:** RACQITO = Resource Availability Continuous Quality Improvement Trade-off, refers to general systemic overload, where limitations in resource availability within the ED and hospital produce trade-offs against quality decision making.

Source: Adapted from: Graber M, Gordon R, Franklin N. Reducing diagnostic errors in medicine: What's the goal? *Acad Med* 2002;77:981-992.

pain in his right foot, no x-rays of the foot were performed. Braun subsequently sought an opinion from another physician who did order x-rays of the foot, revealing a fractured calcaneus. An orthopedic shoe failed to relieve Braun's pain and he subsequently underwent a bone fusion procedure approximately 18 months following the injury. This effectively reduced the pain but resulted in some shortening of his leg.

Discussion. Emergency physicians should consider three possibilities with falls from this height, especially onto a hard surface. The first is fracture of one or both calcanei, the second an associated injury to the lumbar spine, and the third that the patient might have intentionally jumped, possibly with suicidal intent. Other complaints and injuries notwithstanding, each of these possibilities should be considered under the rule-out-worst-case scenario (ROWS). (See

Insert for description of base-rate neglect and other CDRs discussed.) Prudent ED physicians should satisfy themselves of the absence of such injuries in the physical exam. Any residual doubt mandates routine x-ray examinations of the respective areas. The fracture of the ankle would have been expected to produce some distraction on physical exam, and the proximity of this injury to the calcaneus should have raised the suspicion of an associated injury. The diagnostic error in this case is a missed calcaneal fracture, and indicates, firstly, a knowledge deficiency type of cognitive error (see **Table 2**).

The second error involves search satisficing (settling on an outcome or answer that is just good enough). There is a universal tendency to call off a search once significant findings are made. There is a maxim in the ED that states: The most commonly missed fracture is the second. The finding of a fracture of the ankle should, therefore, have precipitated a continued search for a second fracture, especially given the circumstances of the accident. Search satisficing often results in missed fractures or significant soft-tissue injuries, but also results in missed foreign bodies, toxins, and other findings. As well, the diagnosis of comorbid conditions also may be missed. Cognitive forcing strategies have been proposed to minimize search satisficing.¹¹ In this case, the strategy would be that on finding a fracture, a search should always be made for a second or third.

The third error is on the part of the orthopedic surgeon. Once the ED physician has made the diagnosis of ankle fracture, diagnosis momentum is established, premature diagnostic closure occurs (see **Table 2**), and further thinking stops. The orthopedic specialist has, therefore, inherited the ED physician's thinking. Despite the patient complaining of pain in the foot, and without now the distracting influence of the ankle fracture, the orthopedic surgeon's thinking remains closed.

Case No. 2: Stroke

*Wilburn v. Cleveland Psychiatric Institute.*¹² Edna Wilburn began experiencing stroke-like symptoms on Feb. 26, 1994, and went to the ED at University Hospitals of Cleveland. A stroke protocol was initiated, but as CT scan and blood work appeared normal, she was referred to the psychiatry service. A diagnosis of conversion reaction was made. Her symptoms improved and she was discharged home the same day.

The following day, her symptoms worsened and she presented again to the same ED. On physical exam, a positive Babinski reflex was found. Nevertheless, she was diagnosed again with conversion disorder and referred to the Cleveland Psychiatric Institute (CPI). The referral note included a request for a neurological consultation and requisition for EEG. She was declared medically clear otherwise.

On Feb. 28, she was admitted to psychiatry. The EEG and neurological requests were canceled by a staff psychiatrist. A staff physician conducted an incomplete physical examination which did not include full neurological testing to assess the previous Babinski finding, her medical records from other hospitals were not reviewed, and no further tests were done. She remained on the psychiatry service for more than three weeks, during which time she experienced repeated falls and urinary incontinence. She was discharged to an outpatient mental health facility, despite being unable to ambulate satisfactorily.

Eighteen days later, she suffered a severe and disabling stroke. She was taken to another medical center where she was seen by a neurologist who diagnosed stroke secondary to thrombotic thrombocytopenic purpura (TTP).

Discussion. The principal error here is the misdiagnosis of a patient with a psychiatric condition when there is an independent medical diagnosis that accounts for the patient's symptoms. This is the most common of a cluster of errors associated with psychiatric diagnoses, subsumed under psych-out errors, and has been described in more detail in the context of the ED.⁶ Inevitably, the ED often is the nexus of such errors, although they can occur anywhere in the health care system.

The first issue arises out of the medical clearance of psychiatric patients from the ED. The term 'medical clearance' is misleading and may lead to misdiagnosis and other misunderstandings.¹³ To say that a patient referred to psychiatry is "medically cleared" carries the implicit assumption that no organic basis exists for the patient's condition and it remains only to establish a psychiatric diagnosis and treatment. "Stabilization" or other more open-ended descriptions do not put closure against the possibility that further medical work-up may be necessary down the road. The question, then, is whether or not Wilburn was adequately "cleared." In fact, she was declared "medically cleared" before admission to CPI, although lingering doubt by the ED physician is

evident, insofar as an EEG and neurological consultation were requested. Certainly, a CT of the head would detect a hemorrhagic event but does not rule out transient ischemic attack (TIA) which may often presage stroke. Further, if an infarct had occurred no findings may be evident on CT for up to 12 hours. In hindsight, given that the patient's symptoms had improved that day, she probably had suffered a TIA at the first presentation to the ED. However, if the clinical signs and symptoms of a cerebrovascular event were compelling at that point (a stroke protocol was initiated), then the appropriate referral would have been to neurology to rule this out. Therefore, this is first an error of triage cueing. Instead of the more appropriate neurological referral, the ED physician sends the patient to psychiatry which sets in motion a series of errors that have their basis in diagnosis momentum and premature diagnostic closure.

There is a saying in the ED that "Geography is destiny,"¹⁴ indicating that wherever the patient goes in the system determines their treatment and perhaps his or her fate. When the first psychiatrist assesses the patient, he assumes medical clearance and then makes an effort to fit the patient's symptoms into the psychiatric classification of disease. The ischemic effects on the brain that occur in TTP classically result in bizarre findings, as are those associated with conversion disorder. Thus, the psychiatric diagnosis is not surprising. Nevertheless, conversion disorder is a diagnosis of exclusion, as every ED physician should be aware, and necessitates re-doubled effort to exclude a medical cause. There are a number of medical conditions that typically manifest as psychiatric disorders¹⁵ which, along with other reasons, leads to medical diagnoses being often missed in the ED. Once the patient is in psychiatric hands, one half of major medical diagnoses may be missed.¹⁶

When Wilburn presented on the second occasion with worsening symptoms, she was admitted to the CPI. In the course of her stay there, it appears that she did suffer a cerebrovascular event, evidenced by repeated falls and urinary incontinence. The staff psychiatrist, nevertheless, persisted with his diagnosis of conversion disorder, and cancelled the ED physician's request for an EEG and neurological consultation, reflecting both confirmation bias and overconfidence. The failure of another staff physician to conduct a complete physical examination and review the patient's ED and past medical

Table 3. Classes of Patients in Whom MI Is Likely to Be Missed

- Atypical presentations
- Patients with anginal equivalent symptoms, or silent ischemia
- Young patients
- Elderly patients
- Inpatients
- Patients with pre-existing pulmonary or gastrointestinal disease
- Patients with rare hematological disorders (e.g., TTP, hyperviscosity syndromes)
- Psychiatric patients, in general
- Somatoform disorder patients, in particular
- Diabetics
- "Frequent flyers" (individuals frequently seen in the ED)
- Females
- Alcoholics, drug users

records, is an example of anchoring onto the previous diagnosis and results in premature diagnostic closure. The second ED record indicated a positive Babinski reflex, which clearly cannot be explained by conversion disorder. This failing is especially unsatisfactory, as the CPI claimed to have access to facilities to address patient's medical needs, and had a neurologist under contract. The particular recalcitrance of the staff psychiatrist towards re-visiting his diagnosis illustrates too, perhaps, an example of sunk costs. Three weeks on a psychiatric ward establishes a significant investment of time and effort, and considerable inertia mounts against letting go of a failing diagnosis.

Case No. 3: Myocardial Infarct

*Knuth v. Emergency Care Consultants, P.A.*¹⁷

Cheryl Knuth, a 44-year-old woman, was involved in an automobile accident on Nov. 26, 1995, in which she sustained a concussion, cervical strain, and soft-tissue injury to her left hip. During a period of three months, from Dec. 31, 1995, to April 1996, she presented on nine different occasions to the Abbott Northwestern Hospital ED, run by Emergency Care Consultants (ECC). On at least five of these occasions, she complained of pain/spasms in her neck, chest, and arm on her left side. She believed these symptoms were related to her automobile accident. Neither the nurse practitioner nor the ED physicians who assessed and treated her conducted tests to determine if her symptoms might be of a cardiac origin. There was some skepticism on the part of ED

personnel that the accident was responsible for her symptoms, and the possibility raised that her visits might be associated with drug-seeking behavior. Knuth died on April 11, 1996, from a myocardial infarct (MI). Autopsy revealed a 95% occlusion of her left anterior descending artery. There also was pathological evidence of two prior MIs.

Discussion. Nine visits to an ED over a three-month period puts Knuth into a category of patients, known colloquially and somewhat disparagingly to ED personnel as "frequent flyers." In using this term, the underlying implication is that such patients are inappropriately using the ED for trivial complaints, often distracting the ED from its true purpose, the diagnosis and management of serious injury and disease. Inevitably, following repeated visits, there is an accumulating tendency for the patient's complaints to be minimized and dismissed.

Classifying patients in this way is an example of fundamental attribution error, i.e., the problem is attributed to dispositional qualities of the patient rather than their situational circumstances, or underlying medical condition. Patients suffering from variations of the often debilitating somatoform disorders usually end up being judged in this way. Others, such as those with factitious disorders, malingerers, or others who deliberately misrepresent their illness (such as drug-seekers), also may qualify as frequent flyers, and are classified as no-fault diagnostic failures (see **Table 2**). The skepticism surrounding Knuth's conviction that her symptoms were due to the automobile accident raises a not infrequent concern among ED personnel that they might be being used to support a medicolegal claim. Further, raising the possibility that Knuth's repeated visits might be due to drug-seeking behavior is a similar judgmental behavior on the part of ED personnel, that mitigates against a full consideration of a genuine medical basis for her complaints. The drug-seeking label is likely to give rise to a negative counter-transference, generating antipathy toward the patient. Such affective involvement on the part of ED personnel may exacerbate the patient's condition, resulting in iatrogenic illness.¹⁸

When Knuth presents on successive occasions to the ED, these collective attributes combine to anchor ED personnel on spurious explanations for her complaints and her true diagnosis is missed. Once the pattern is established, it is maintained by diagnosis momentum and premature diagnostic closure, as in

the two previous cases. Nevertheless, it is somewhat remarkable in the present case that the power of such biases was such that no one in the course of her visits saw fit to give her the benefit of the doubt and initiate a routine work-up that might have detected her underlying disease. Thus, when patients get labeled as “frequent flyers,” extra caution should be exercised by ED personnel to ensure that serious diagnoses are not being overlooked; it is one of the rules.

Finally, a number of issues around missed MIs have been raised in a previous *ED Legal Letter* by Dunn.¹⁹ Up to 10% of MIs, and many cases of unstable and new onset angina, are missed. There are no prizes for diagnosing classic presentations of angina or MI; it is expected. However, where clinical acumen may triumph, but where some ED physicians fail, is with atypical cases (i.e., those that do not fit the prototype that is taught in medical training). This is an example of the CDR, representativeness restraint. The ED physician is restrained from pursuing a diagnosis because the patient’s signs and symptoms are not representative of the class of patients who typically have the disease in question. **Table 3** provides a summary of classes of patients in whom the diagnosis of MI or unstable angina is likely to be missed. Besides the various CDRs described above, contributing factors in the failure to diagnose Knuth with cardiac disease may have been that she was relatively young and female.

At the initial District Court hearing, the jury returned a verdict in favor of the plaintiff and awarded damages of \$200,000 for negligence on the part of the hospital and ECC. Although ECC’s motion for a new trial was granted, this was subsequently overturned by the Court of Appeals of Minnesota.

Case No. 4: Meningitis

*Tharp v. Parkview Community Hospital.*²⁰ On Feb. 16, 1998, Erin Tharp, a 14-year-old girl saw her pediatrician for a complaint of an upper respiratory tract infection (URTI) and productive cough of several weeks’ duration. She also reported two episodes of left-sided facial numbness, each of which lasted 15 minutes. Laboratory and x-ray studies were ordered, and she was started on antibiotics and referred to the clinic of a pediatric neurologist. According to her parents, the following morning she became “hysterical and began hyperventilating.” She was taken by her father to the ED with complaints of

headache, weakness, hyperventilation, URTI symptoms, right facial numbness and weight loss. She was examined by the ED physician, and a CT scan of her head was ordered. The x-rays that were taken on the previous day were reviewed and noted to be unremarkable. The ED physician terminated his shift and transferred care to a second ED physician. The results of the CT scan were normal and the patient was discharged with instructions to follow up with her pediatrician the following day.

On Feb. 18, she awoke complaining of double vision. She was taken to her pediatrician at noon. The physical examination was normal other than a left esotropia, a cranial nerve palsy producing the sign of inward deviation of the eye and the symptom of diplopia. She was admitted to hospital, and an MRI was performed that day. The pediatrician discussed the MRI with a radiologist who informed him it was normal. According to the parents, he discussed the report with them on the evening of Feb. 18 and told them it was normal, but that her esotropia was due to raised intracranial pressure. This recollection of the parents is difficult to reconcile as, if the pediatrician believed the patient had raised intracranial pressure at this stage, then immediate steps would have been taken to treat it.

A second radiologist issued a report the following day, Feb. 19, that indicated evidence of possible acute meningitis, and that the cerebellar tonsils had herniated 8 mm below the margin of the skull. The pediatrician was unaware of this report and ordered a lumbar puncture (LP) for that evening. When he arrived for the procedure, however, he found that one of Erin’s pupils was fixed and dilated. He began immediate treatment and ordered a repeat CT scan that showed swelling and increased intracranial pressure.

A pediatric neurosurgeon at another facility was consulted and the patient was transferred there, arriving around midnight. Eight hours later, she underwent a surgical procedure to relieve intracranial pressure. Erin was diagnosed with viral encephalitis that resulted in a progressive demyelination process over several weeks. She was left with severe neurological deficits, including loss of speech, inability to swallow, loss of bladder and bowel function, as well as loss of motor function in her trunk and lower extremities. Passing note is made that Erin had received antibiotics, and an aseptic profile suggesting viral infection is typical in cases of partially treated bacterial infection.

Discussion. The first issue concerns Erin's management during the first presentation to the ED. Arguably, a young girl presenting to an ED with a history of an ongoing URТИ, headache, other neurological symptoms, and with no focus of infection should have raised the suspicion of an incipient or established CNS infective process. The picture of meningitis may be incomplete and nonspecific in younger patients, but focal neurological dysfunction is present in a significant number of cases, including disordered eye movements from cranial nerve abnormalities. Thus, it clearly should have been on the differential diagnosis.

Failure to give it due consideration may be due to the CDR playing the odds. It would have been more prudent, and remains the obligation of ED physicians, to adopt the ROWS strategy. It is not clear what diverted the ED physician from this possibility. The patient had been seen within the last 24 hours by a pediatrician, which may have created a feeling of reassurance to the ED physician that she had been fully assessed by a specialist. This is a mild form of yin-yang error (see **Insert**). Secondly, the history of the patient being "hysterical and hyperventilating" might have suggested a psychological cause for her symptoms. Facial paresthesia frequently is associated with hyperventilation, but usually is circumoral rather than the unilateral description given in this case. Nevertheless, x-rays were reviewed and a CT scan was ordered.

The patient was then transferred to the care of another ED physician. Such transitions of care represent discontinuities and vulnerable points in a patient's management in the ED²¹ and qualify as an error-producing condition (see **Table 1**). Transitions of care may have adverse outcomes on patient care, but they also provide opportunities for fresh thinking and recovery. The report that the CT scan was normal clearly does not exclude meningitis and, given the history of a recent infective process and neurological symptoms, an LP would have been appropriate. If the goal of the CT scan was to rule out an intracranial mass to explain the patient's neurological symptoms, then a normal scan should have precipitated a search for other causes of the CNS abnormalities. In effect, the normal CT scan led to search satisficing resulting in the search for an explanation for the neurological symptoms being called off when no abnormality was found. Given the patient's symptoms, a thorough reassessment clearly was indicated, but was not done. The unpacking principle was not applied, again the ROWS strategy not pursued, and the patient discharged from the ED. No

matter what information and clinical impressions were transferred to the second ED physician at shift changeover, the responsibility for the safe discharge of the patient ultimately rests with the second.

The second issue concerns the misreading of the MRI as normal on Feb. 18, and reflects a knowledge deficiency type of cognitive error (see **Table 2**). Had it been correctly read, it would have bought a valuable 24 hours before the precipitous deterioration became evident. Also, given that the hard finding of a cranial nerve abnormality had emerged on Feb. 18, with no obvious abnormality on the CT scan to explain it, an opportunity presented itself for the pediatrician to revisit his differential diagnosis, perhaps attaching a stronger weight to the possibility of meningitis. An unwillingness to do so often reflects confirmation bias.

The third issue concerns the MRI reports. There are two problems here. The first concerns the discrepancy between the verbal report of the MRI and the final report. When verbal reports are given, they should be written down and a note made when the information was verbally communicated and to whom. The radiologist who issued the second report would then have been aware of the discrepancy and, recognizing its significance, could have communicated this immediately to the pediatric neurologist. The second issue is that the final MRI report failed to reach the pediatrician on Feb. 19. Had the report arrived sooner, more time again would have been available to provide possible amelioration of the patient's condition. When he came to do the LP that evening, he remained unaware that the MRI indicated meningitis and uncal herniation. A report of this nature should have been conveyed STAT to those responsible for her care. Such time delays and inefficiencies in follow-up of reports are characteristic of systemic types of error-producing conditions (see **Table 2**). It is disconcerting to think that had the patient's pupil not blown, or other clinical signs of raised intracranial pressure not been present, the LP might have gone ahead, despite an extant radiology report clearly indicating raised intracranial pressure. Although it is not known whether these delays might have affected the final outcome or not, it is always better in emergent situations to have time on one's side.

The Superior Court entered judgment in favor of the defendants. The verdict was appealed, in part, on the grounds that a complete deposition from the first

(Continued on page 118)

Table 4. Cognitive De-Biasing Strategies to Reduce Diagnostic Error

STRATEGY	MECHANISM	ACTION
Develop insight and awareness	Provide detailed descriptions and thorough characterizations of CDRs.	Develop multiple clinical teaching examples of major CDRs, illustrating their adverse effects on decision making and diagnosis formulation.
Consider alternatives	Establish forced consideration of alternative possibilities.	Reinforce the generation and working through of a differential diagnosis. Encourage always asking the question: What else might this be?
Metacognition	Train for a reflective approach to problem solving: stepping back from the immediate problem to examine and reflect on the thinking process.	Develop generic and specific cognitive forcing strategies for predictable diagnostic pitfalls.
Decrease reliance on memory	Improve the accuracy of judgments through cognitive aids.	Mnemonics, clinical practice guidelines, algorithms, charts, hand-held computers.
Specific training	Identify specific flaws and biases in thinking and provide directed training to overcome them.	Provide didactic instruction in fundamental rules of probability.
Simulation	Develop mental rehearsal, "cognitive walk-through," strategies for specific CDRs.	Construct clinical training videos contrasting incorrect (biased) approaches with the correct (unbiased) approach.
Make task easier	Provide more information about the specific problem to reduce task difficulty and ambiguity.	Make available rapid access to concise, clear, well-organized information.
Minimize time pressures	Provide adequate time for quality decision making.	Ensure adequate staffing to avoid cognitive overload.
Accountability	Establish clear accountability and follow-up for decisions made.	Remove any ambiguity about who is responsible for a patient's care, especially at shift handover, and who is responsible for follow-up.
Feedback	Provide as rapid and reliable feedback as possible to decision makers so that errors are immediately appreciated, understood, and corrected, resulting in better calibration of decision makers.	Establish mechanisms to provide timely information on patient outcomes. Ensure discharge summaries are always provided to those physicians involved in a patient's care.

Key: **CDR** = cognitive disposition to respond

Source: Adapted from Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med* 2003;78:1-6.

radiologist who read the MRI had not been entered at trial, and that delayed diagnosis was cause to a reasonable medical probability. However, the original verdict was upheld at the Court of Appeals.

It should be emphasized that the present discussion is made in hindsight, with all the advantages that such analysis offers. However, it is vulnerable to hindsight bias, which may either underestimate or overestimate the quality of various decisions made throughout the course of events. Despite these limitations, such cognitive autopsies provide important opportunities for learning, and this is the spirit in which it is offered here. Notwithstanding the favorable outcome to the defendants, this discussion highlights some important issues in the management of Erin's care.

Avoiding Diagnostic Error

Although there are many sources of error in the diagnostic process, strategies are available to overcome them. The first is to be alert for warning signs that all is not well and establish some general rules for your facility.

The second is to focus, in an immediate and practical way, on the decision making process within the special milieu of the ED. During the last 30 years, psychologists have made significant inroads into explaining the conditions and predisposing factors that give rise to poor decisions, and there is a rich literature on the topic. Emergency medicine, and especially its educators, must adopt what has been learned from cognitive decision theory, and incorporate it into clinical decision making. Specifically, strategies and practical courses of action should be developed to de-bias CDRs. A summary of the various strategies that have been proposed is provided in **Table 4**. The important strategy of metacognition, which involves stepping back and reflecting on one's thinking, recently has been described in detail.¹¹ All EDs have their own unique operating conditions, and residents and attending physicians should review these strategies in their own EDs to avoid those CDRs that might lead to bad outcomes. Morbidity and mortality rounds in the ED should be re-structured to promote cognitive autopsies (i.e, a discussion and analysis of thinking failures). In the last three years, both the undergraduate and postgraduate programs at Dalhousie University have introduced new courses on medical error that use cognitive autopsy of case material, along with

instruction in cognitive forcing strategies.¹¹ It appears to be a popular and effective innovation with both undergraduates and postgraduates.²²

Conclusions

These cases illustrate a number of CDRs in decision making, as well as other error-producing conditions that lead to delayed or failed diagnoses. It is critically important for ED residents and attending physicians to fully familiarize themselves with the known CDRs to offset their distracting influence on decision making. A working knowledge of them will provide a language for describing thinking failures and provide insight into those cases in which the diagnostic process has failed. Two important ones that appear to predominate in these case discussions are search satisficing, which often leads to premature diagnostic closure, and ED physicians should be especially familiar with them. Inevitably, a working familiarity with all CDRs must be established and incorporated into clinical teaching. If this approach is ignored, those in training, as well as those in practice, are destined to repeat diagnostic failures. Good diagnosticians are those who have learned, often to their chagrin, how to avoid these cognitive pitfalls.

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CE/CME Questions

13. The tendency to be judgmental and blame patients for their illnesses, or to assume "frequent flyers" always are using the ED inappropriately for trivial complaints, is an example of fundamental attribution error.
 - A. True
 - B. False
14. The effect of representativeness restraint on diagnostic formulation is to:
 - A. Ensure the differential diagnosis is complete.
 - B. Force a consideration of atypical presentations.
 - C. Exclude any unlikely diagnostic possibilities.
 - D. Accomplish the correct diagnosis in an expedient fashion.
 - E. Focus on prototypical presentations of disease.

15. Regarding search satisficing, which of the following statements is true?
 - A. It ensures that no additional findings are missed.
 - B. It results in an early and accurate diagnosis.
 - C. It provides satisfaction that all possibilities have been considered.
 - D. It is the tendency to stop the search when the first finding

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is made.

- E. The clinician is satisfied that an appropriate search has been made.
16. The expression, “Geography is destiny” implies that:
- A. The right patient will be seen in the right place in the ED.
 - B. A triage cueing error might have occurred.
 - C. There is a racial disposition toward certain diseases.
 - D. Consultation to a specialty still leaves the diagnosis open.
 - E. Where patients are in the system affects their outcome.

Answer Key:

13. A; 14. E; 15. D; 16. E.

Audio Conference Clarifies Final EMTALA Regulations

The final version of the recently proposed changes to the Emergency Medical Treatment and Labor Act (EMTALA) takes effect on Nov. 10.

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In Future Issues:

The Final EMTALA Revisions

Insert. A Catalogue of Cognitive Dispositions to Respond (CDRs) that May Lead to Diagnostic Error

Aggregate bias: When physicians believe that aggregated data, such as those used to develop clinical practice guidelines, do not apply to individual patients (especially their own), they are invoking the aggregate fallacy. The belief that their patients are atypical or somehow exceptional may lead to errors of commission; e.g., ordering x-rays or other tests when guidelines indicate none are required.

Anchoring: The tendency to perceptually lock on to salient features in the patient's initial presentation too early in the diagnostic process, and failing to adjust this initial impression in the light of later information. This CDR may be severely compounded by the **confirmation bias**.

Ascertainment bias: Occurs when a physician's thinking is shaped by prior expectation; stereotyping and gender biases are examples.

Availability: The disposition to judge things as being more likely, or frequently occurring, if they readily come to mind. Thus, recent experience with a disease may inflate the likelihood of its being diagnosed. Conversely, if a disease has not been seen for a long time, it may be underdiagnosed.

Base-rate neglect: The tendency to ignore the true prevalence of a disease, either inflating or reducing its base-rate, and distorting Bayesian reasoning. However, in some cases, clinicians may (consciously or otherwise) deliberately inflate the likelihood of disease, as in the strategy of "rule-out-worst-case scenario" to avoid missing a rare but significant diagnosis.

Commission bias: Results from the obligation toward beneficence, in that harm to the patient can only be prevented by active intervention. It is the tendency toward action rather than inaction, and is more likely in overconfident physicians. Commission bias is less common than omission bias.

Confirmation bias: The tendency to look for confirming evidence to support a diagnosis rather than look for disconfirming evidence to refute it, despite the latter often being more persuasive and definitive.

Diagnosis momentum: Once diagnostic labels are attached to patients they tend to become stickier and stickier. Through intermediaries, (e.g., patients, paramedics, nurses, and physicians) what might have started as a possibility gathers increasing momentum until it becomes definite and all other possibilities are excluded.

Feedback sanction: A form of ignorance trap and time-delay trap CDR. Making a diagnostic error may carry no immediate consequences, as considerable time may elapse before the error is discovered, if ever, or poor system feedback processes prevent important information on decisions getting back to the decision maker. The particular CDR that failed the patient persists because of these temporal and systemic sanctions.

Framing effect: How diagnosticians see things may be influenced strongly by the way in which the problem is framed; e.g., physicians' perceptions of risk to the patient may be influenced strongly by whether the outcome is expressed in terms of the possibility that the patient may die or that they might live. In terms of diagnosis, physicians should be aware of how patients, nurses, and other physicians frame potential outcomes and contingencies of the clinical problem to them.

Fundamental attribution error: The tendency to be judgmental and blame patients for their illnesses (dispositional causes) rather than examine the circumstances (situational factors) that might have been responsible. In particular, psychiatric patients, minorities and other marginalized groups tend to suffer from this CDR.

Gambler's Fallacy: Attributed to gamblers, the belief that if a coin is tossed 10 times and is heads each time, the 11th toss has a greater chance of being tails (even though a fair coin has no memory). An example would be a physician who sees a series of patients with chest pain in clinic or the ED, diagnoses all with an acute coronary syndrome, and assumes the sequence will *not* continue.

Gender bias: The tendency to believe that gender is a determining factor in the probability of diagnosis of a particular disease when no such pathophysiological basis exists.

Hindsight bias: Knowing the outcome may profoundly influence perception of past events and prevent a realistic appraisal of what actually occurred. In the context of diagnostic error, it may compromise learning through either an underestimation (illusion of failure) or overestimation (illusion of control) of the decision maker's abilities.

Multiple alternatives bias: A multiplicity of options on a differential diagnosis may lead to significant conflict and uncertainty. The process may be simplified by reverting to a smaller subset with which the physician is familiar, but may result in inadequate consideration of other possibilities. One such strategy is the three-diagnosis differential: "It is probably A, but it might be B, or I don't know [C]." While this approach has some heuristic value, if the disease falls in the C category and is not pursued adequately, it will minimize the chances that some serious diagnoses can be made.

Omission bias: The tendency toward inaction, rooted in the principle of nonmaleficence. In hindsight, events that have occurred through the natural progression of a disease are more acceptable than those that may be attributed directly to the action of the physician. The bias may be sustained by the reinforcement often associated with not doing anything, but may prove disastrous.

Order effects: Information transfer is a U-function: A tendency to remember the beginning part (primacy effect) or the end (recency effect). Primacy effect may be augmented by anchoring. In

translations of care, where information transferred from patients, nurses, or other physicians is being evaluated, care should be taken to give due consideration to all information, regardless of the order in which it was presented.

Outcome bias: The tendency to opt for diagnostic decisions that will lead to good outcomes, rather than those associated with bad outcomes, thereby avoiding chagrin associated with the latter. It is a form of value bias in that physicians may express a stronger likelihood in their decision making for what they hope will happen rather than what they really believe might happen. This may result in serious diagnoses being minimized.

Overconfidence bias: There is a universal tendency to believe we know more than we do. Overconfidence reflects a tendency to act on incomplete information, intuitions or hunches. Too much faith is placed in opinion instead of carefully gathered evidence.

Playing the odds: Also known as frequency gambling. The tendency in equivocal or ambiguous presentations to opt for a benign diagnosis on the basis that it is significantly more likely than a serious one.

Posterior probability error: Occurs when a physician's estimate for the likelihood of disease is unduly influenced by what has gone before for a particular patient. It is the opposite of the Gambler's fallacy in that the physician is gambling on the sequence continuing.

Premature closure: A powerful CDR accounting for a high proportion of missed diagnoses. It is the tendency to apply premature closure to the decision-making process, and accepting a diagnosis before it has been fully verified. The consequences of the bias are reflected in the maxim, "When the diagnosis is made, the thinking stops."

Psych-out error: Psychiatric patients appear to be particularly vulnerable to the CDRs described in this list, and to other errors in their management, some of which may exacerbate their condition. They appear especially vulnerable to fundamental attribution error. A variant of psych-out error occurs when serious medical conditions are misdiagnosed as psychiatric conditions.

Representativeness restraint: Drives the diagnostician towards looking for prototypical manifestations of disease: "If it looks like a duck, walks like a duck, and quacks like a duck, then it is a duck." Yet restraining decision making along these pattern recognition lines leads to atypical variants being missed.

Search satisficing: Reflects the universal tendency to call off a search once something is found. Comorbidities, second foreign bodies, other fractures, and coingestants in poisoning may all be missed.

Sutton's slip: Takes its name from the apocryphal story of the Brooklyn bank robber Willie Sutton, who, when asked by a judge why he robbed banks, is alleged to have replied, "Because that's where the money is!" The diagnostic strategy of going for the obvious is referred to as Sutton's Law. The slip occurs when possibilities other than the obvious are not given sufficient consideration.

Sunk costs: The more clinicians invest in a particular diagnosis, the less likely they may be to release it and consider alternatives. This is an entrapment form of CDR more associated with investment and financial considerations. However, for the diagnostician, the investment is time and mental energy, and for some ego may be a precious investment.

Triage cueing: The triage process occurs throughout the health care system, from self-triage by patients to the selection of specialists by the referring physician. In the ED, triage is a formal process that results in patients being sent in particular directions that cue their subsequent management. Many CDRs are initiated at triage, leading to the maxim, "Geography is destiny."

Unpacking principle: Failure to elicit all relevant information (unpacking) in establishing a differential diagnosis may result in significant possibilities being missed.

Vertical line failure: Routine, repetitive tasks often lead to thinking in silos — predictable, orthodox styles that emphasize economy, efficacy, and utility. Though often rewarded, the approach carries the inherent penalty of inflexibility. In contrast, lateral thinking styles create opportunities for diagnosing the unexpected, rare or esoteric. An effective lateral thinking strategy is simply to pose the question: "What else might this be?"

Visceral bias: The influence of affective sources of error on decision-making has been widely underestimated. Visceral arousal leads to poor decisions. Countertransference, both negative and positive feelings toward patients, may result in diagnoses being missed.

Yin-yang out: When patients have been subjected to exhaustive and unavailing diagnostic investigations, they are said to have been "worked up the yin-yang." The yin-yang out is the tendency to believe that nothing further can be done to throw light on the dark place where, and if, any definitive diagnosis resides for the patient; i.e., the physician is let out of further diagnostic effort.

Source: Adapted with permission from Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med* 2003;78:1-6. There is considerable overlap among CDRs, some being known by other synonyms. These, together with further detail and citations for the original work, are described in Croskerry P. Achieving quality in clinical decision making: Cognitive strategies and detection of bias. *Acad Emerg Med* 2002;9:1184-1204; and Hogarth RM. *Judgment and Choice: The Psychology of Decision*. Chichester, England: Wiley; 1980.