Clinical Decision Making: An Emergency Medicine Perspective

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Abstract. Clinical decision making (CDM) describes a form of qualitative inquiry that examines the thought processes involved in making medical decisions. A significant body of literature exists on the orderly “hypothetico-deductive” model of clinical decision making. However, very little has been written on how CDM differs in the acute setting. This paper reviews the common methods of CDM and their relevance to emergency medicine (EM). The concept of diagnostic uncertainty and the utility of the diagnosis of unknown etiology in the disposition phase of the emergency patient visit are discussed. Finally, a unique EM perspective on clinical decision-making errors is presented. Key words: clinical decision making; clinical reasoning; cognitive errors. ACADEMIC EMERGENCY MEDICINE 1999; 6:947–952

THE ED is a unique environment of uncontrollable patient volume and brief clinical encounters of variable acuity. The emergency physician (EP) must often make complicated clinical decisions with limited information while faced with a multitude of competing demands and distractions. Little is known about how this clinical environment may affect the decision-making process of EPs.

Clinical reasoning, medical problem solving, diagnostic reasoning, and decision analysis are all terms used in a growing body of literature that examines how physicians make clinical decisions. Decision analysis is a quantitative approach used to assess the risk vs benefit of diagnostic and therapeutic decisions.1 This methodology is often criticized as an impractical and time-consuming process.2 The qualitative inquiry of clinical decision making examines the cognitive processes involved in reaching clinical decisions. Although some may question the utility of such inquiry, its relevance becomes clear when we examine our changing educational and practice environments.

Traditionally medical education has focused on the content rather than the process of clinical decision making.3 Educational and social reform, however, have led to change. At the undergraduate level, problem-based learning has become an accepted educational process. More recently, evidence-based medicine has been promoted as an approach (or process) to teach and practice medicine at the postgraduate level.4 For the practicing physician, the decision-making process is increasingly being influenced by clinical standards created as policy statements from respective clinical organizations.5 In addition, demands for increased physician accountability have forced both external (national organizations, hospitals, and clinical departments) and internal (clinicians) evaluation of the clinical decision-making process.

The study of clinical decision making has mostly involved the direct observation of physicians “thinking aloud” during simulated patient encounters.6,7 Newell and Simon,8 Elstein et al.,9 and Kassirer and Gorry10 have all made significant contributions to the literature and our understanding of the clinical decision-making process. However, there has been little written on how the decision-making process might vary beyond the traditional patient–physician encounter.

In this article, the literature is reviewed and insight offered from an emergency medicine (EM) perspective on the clinical decision-making process. The use of clinical decision strategies, as well as issues of diagnostic uncertainty and error in the clinical decision-making process, is examined.
CLINICAL DECISION-MAKING STRATEGIES

Several strategies or models are thought to be used during the clinical decision-making process. Two of these proposed strategies are reviewed from an EM perspective.

The Hypothetico-deductive Model. Adapted from psychology research and scientific method, the hypothetico-deductive model is the most widely studied and accepted model of clinical decision making.

You pick up the next chart and glance at the presenting complaint, name, age, vital signs, and nursing/triage note of the patient you are about to see in the ED. The patient is a 38-year-old woman with a complaint of headache, associated nausea and vomiting, and a past history of migraines. Her vital signs are normal. You pull the curtain to see the patient curled up in a stretcher, overhead light off, clutching her forehead with one hand while holding a basin in the other, trying not to disturb the intravenous line already in place.

Hypothesis Generation. The first stage of the hypothetico-deductive model is hypothesis generation. Several independent investigators concluded that physicians proceed with the diagnostic process after initially generating hypotheses. Although the sequence and terminology subsequent to hypothesis generation vary in the literature, there are similarities (summarized in Table 1). One or more diagnostic hypotheses are generated early in the scheme, often even before the clinical encounter with the patient has begun. Although hypothesis generation often begins early, hypotheses can be triggered at all stages of the clinical encounter (from history, physical exam, and/or lab results). Factors thought to be important in hypothesis generation are disease prevalence, heuristics, and the acuity of the patient’s condition.

Prevalence. When the prevalence of disease is considered along with the information (presenting complaint, age, vital signs, and triage note) in the above case, most clinicians would proceed with the hypothesis of migraine as the etiology of this patient’s presentation. Consideration of prevalence is important during hypothesis generation not only because common things are common, but because it will affect the ensuing clinical decision-making process. If the hypotheses are considered without regard for prevalence, then tests that are not highly specific will result in a high false-positive rate. Unfortunately, disease prevalence cannot be used as a sole mechanism of hypothesis generation, because it would often require the consideration of an excessive range of etiologies.

Heuristics. Experts differ from novices in clinical decision-making strategy by their ability to focus and be selective. In addition to their accumulated knowledge, expertise, and experience, experts organize their information into meaningful parts. The experienced decision maker often uses rules of thumb or short cuts termed heuristics. These heuristics are necessary tools that increase the expert’s efficiency. Representative heuristics simply involve linking key features of a patient’s presentation to a known clinical entity such as recognizing a description of a sudden “worst ever” headache as a possible subarachnoid hemorrhage. Availability heuristics require significant experience with a clinical entity that is then referenced or recalled when a striking feature or presentation is encountered clinically. Neither of these heuristics considers prevalence.

Acuity. Finally and perhaps most relevant to the EP, hypothesis generation often considers the acuity of the patient’s presentation. The EP approaches and organizes his or her hypotheses into emergent and nonemergent conditions. For the above case, migraine represents a specific diagnosis; however, quite frequently hypothesis generation is more general. In this case the two general competing hypotheses are those of a benign headache (tension or migraine) and a potentially catastrophic headache (subarachnoid hemorrhage, meningitis, increased intracranial pressure).

Hypothesis Evaluation. In the next stage of hypothesis evaluation, a context or framework is created and used as a guide to gather more information. The two major strategies used at this stage are confirmation and elimination. Most non-emergency clinicians approach patients with the intention of hypothesis confirmation. However, EPs quite often seek to eliminate potentially life-threatening diagnoses or discriminate acute from nonacute problems. The method used depends on the patient’s presentation.

If the patient in the above example had no previous history of similar headaches before and presents with her “worst ever” headache, the EP would pursue an elimination strategy and investigate with a CT plus or minus lumbar puncture (LP) to exclude subarachnoid hemorrhage. With this life-threatening condition excluded, the experienced EP would most likely continue symptomatic management without the need of confirmation and diagnostic closure.

Hypothesis Refinement. The next stage of the hypothetico-deductive model, hypothesis refinement, may occur concurrently with hypothesis evaluation. As information is gathered, the previously generated hypotheses are refined, making
some more specific while dropping others. Hypotheses are often prioritized in terms of likelihood (prevalence) and considered for elimination or confirmation based on the acuity of the patient’s presentation.

**Hypothesis Verification.** Kassirer and Copelman define hypothesis verification as a final check before action in the hypothetico-deductive model. Before accepting a working diagnosis, the hypothesis is retrospectively considered for its adequacy (is the presentation consistent with the hypothesis?), coherency (appropriateness of causal or pathophysiologic links), and parsimonious nature (simplest possible explanation) before accepting a working diagnosis.¹²

Emergency physicians using the hypothetico-deductive model as a clinical decision-making process often stop short of verification since confirmation and diagnostic closure are often not achieved or even sought (see below). Although EPs likely use the hypothetico-deductive model in a modified form, other clinical decision-making processes are used.

**If, Then Medicine: The Algorithm.** Algorithms use flow charts as an attempt to simplify the diagnostic process into a series of steps. Some may consider the algorithm intellectually inferior to the more scientific method of the hypothetico-deductive model; however, most algorithms are based on evidence and expert consensus.

Increasingly, every discipline in medicine is being subjected to the ultimate if, then guide to patient care in the form of clinical standards or practice guidelines. These guidelines have been criticized by some as “cookbook medicine.” Developed in an attempt to standardize care and serve as a reference for expectations of care, these guidelines are most frequently used retrospectively to judge the appropriateness of care given.⁵ As clinical guidelines become more prevalent, as is anticipated, new graduates will likely use them as learning tools, as they do textbooks and other sources of literature.

Yet in EM the algorithm is an essential tool. The most prevalent examples are the Advanced Cardiac Life Support (ACLS) and Advanced Trauma Life Support (ATLS) algorithms. Both ACLS and ATLS are widely disseminated and accepted clinical decision-making models used in the assessment and management of the cardiac and trauma patient.

On a theoretical level, both ACLS and ATLS algorithms or protocols provide the physician with an approach when acuity and time preclude the use of the hypothetico-deductive model as a clinical decision-making process. In addition, physician anxiety generated by the “crashing” patient is addressed by such algorithms by allowing the clinician to fall back on a protocol. These algorithms do not negate the cognitive process, because the physician must learn the principles and evidence used in their creation. From ACLS and ATLS management of the acutely ill patient came the alphabetical flagship of EM— the ABCs of resuscitation. For the critically ill patient, the physician abandons the hypothetico-deductive strategy, simultaneously assessing and managing the airway, breathing, and circulation of the patient.

### DIAGNOSTIC UNCERTAINTY:
**THE DIAGNOSIS OF UNKNOWN ETIOLOGY**

It is 11 PM in a busy ED. Your relief has just arrived and you begin physician sign-over rounds. He asks how the shift was. You explain that it was one of those high-maintenance days where you feel you didn’t make a diagnosis. He acknowledges your comment with an obvious sense of familiarity. After rounds you sit down to a stack of incomplete charts. You confirm your thoughts of the day as the words “chest pain—unknown etiology,” “abdominal pain—unknown etiology,” and “rash—unknown etiology,” are written at the bottom of the chart in the space labeled “diagnosis.”

It has been well documented that the most common diagnosis (30–50%) of abdominal pain presenting in the ED is that of nonspecific etiology.¹⁶ To the external observer, this representation of diagnostic uncertainty may seem inadequate and difficult to understand. In their use of the hypothetico-deductive model, EPs often stop short of verification and diagnostic closure. However, the term diagnosis of unknown etiology (also referred to as “NYD” or not yet diagnosed) has its place. Kassirer, in his case against excessive testing, comments, “our task is not to attain certainty but rather to reduce the level of diagnostic uncertainty enough to make optimal therapeutic decisions.”¹⁶ He suggests that one of the reasons for excessive testing and disregard for resource utilization is both the physician’s and the patient’s “discomfort with uncertainty.” Three forces are described: external forces such as patient demands and fear of malpractice, internal forces described as “irrational and ossified habits,” and the “zeal for cer-

### TABLE 1. The Hypothetico-deductive Model

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tainty." The EP’s role is not to achieve diagnostic closure for all patients, but to identify those with acute illness who require immediate diagnostic and/or therapeutic intervention. However, in assuming the often unavoidable primary care role, the EP definitively diagnoses and manages the majority of patients seen, while others are deferred back to their family physicians or referred for further assessment.

The EP’s diagnosis of unknown etiology can appropriately temper the zeal for certainty. With a brief clinical encounter and busy environment of the ED, diagnostic closure is often not possible. The diagnosis of unknown etiology is useful in that it avoids labeling the patient with a diagnosis of convenience. Consider the following example:

**A 45-year-old male smoker presents with atypical history of retrosternal chest pain. On exam the only finding is unexplained chest wall tenderness and the ECG is normal. The assessing physician feels comfortable enough that the patient’s chest pain is not likely cardiac and lets him go home.**

The diagnostic entry on the chart could read any of the following, chest wall pain, costochondritis, or chest pain—unknown etiology. The problem with the first two diagnostic entries is that they may imply diagnostic closure, even if unintentional. The patient may be more likely to ignore future chest discomfort, and subsequent EPs may continue to inappropriately reinforce the documented diagnosis. In contrast, chest pain—unknown etiology leaves the case open for patient and physician to explore an alternative diagnosis or further evaluate the patient for ischemic heart disease by, for example, proceeding with exercise stress testing.

It could be argued that the experienced physician should always reconsider a diagnosis if symptoms persist despite therapy and contradict the usual natural history of disease. However, regardless of what discharge instructions were recommended, the diagnosis of unknown etiology, if used appropriately, likely brings an added sense of acuity for the patient and physician to seek further evaluation and therefore avoids premature closure.

The diagnosis of unknown etiology, however, should not be used universally, but be reserved for presentations that are truly of uncertain etiology or where premature closure could misdirect further inquiry. The saying “if it quacks like a duck, it probably is one” bears remembering.

**DECISION-MAKING ERRORS**

*It’s 3 AM and you just finished a 40-minute trauma resuscitation. As you are removing your gloves, the charge nurse reminds you that the family is awaiting news of their 19-year-old son. She also mentions that there are five reassessments and that the nursing supervisor “dropped down to let us know” that there are no more medical beds in the hospital. You close your eyes and swear under your breath. When you look up you see a green July PGY1 hovering to present his patient to you. As you stroll to the other side of the department, with a now-cold cup of coffee in hand, you sneak a glance at the chart rack and estimate a three-hour wait. You try your best to avoid the impatient gazes of patients waiting in the hallway. You hope for daylight and remind yourself to take one patient at a time.*

With an uncontrollable patient volume, mixed acuity, brief patient encounters, and the everyday distractions of a large ED, the environment is often described as “organized chaos.” Most EPs enjoy the acuity, pace, and variety of their work. Not infrequently, however, one reflects on the previous shift wondering whether adequate care was delivered and hoping that chaos did not breed error. Since EM practice rarely provides continuity of care, EPs are less likely to receive feedback regarding the success or failure of their care. What feedback they do receive is often in the form of the dreaded hallway encounter with the opening line, “Do you remember Mrs. X, the patient with chest pain you sent home a few nights ago . . . ?” Feedback and knowledge of errors are crucial to the learning process.

There is no globally accepted classification of errors in clinical medicine. However, to parallel the domains of learning, three broad categories of errors could be used as a framework: cognitive, affective, and psychomotor error. **Affective errors** are most frequently those involving physician communication skills and are a common source of complaints about physician conduct. Psychomotor errors are those related to procedural or technical skills. Finally, **cognitive errors** are those that occur in the clinical decision-making process. Since misdiagnosis is the most frequent complaint against EPs, the pathophysiology of cognitive errors is worthy of investigation.

**Cognitive Errors.** Kassirer and Copelman’s classification of cognitive error parallels the hypothetico-deductive clinical decision-making process
and provides a framework for further discussion (Table 2).²¹

Faulty Hypothesis Generation. Failure to consider or trigger a diagnostic hypothesis is a common error.²² This error of hypothesis generation is more likely to occur in atypical presentations and uncommon diseases.

Faulty Context Formulation. Errors of context formulation occur when a narrow view of the diagnostic hypothesis is considered for further evaluation. Although one might consider these errors to be related to inexperience and lack of knowledge, other factors are at play. The use of heuristics likely contribute to these errors. Representative heuristics are used to assess the “likelihood” of a hypothesis based solely on its close resemblance to a disease presentation.²³ Although this is a necessary clinical heuristic, it can lead to problems. Since uncommon diseases are overrepresented in the literature and reference texts, physicians may neglect prevalence in favor of a more exotic diagnosis.²⁰ This error in the use of representative heuristics is likely not that common in EM. In a busy ED, the EP must often assume a common-things-are-common approach where acuity takes precedence over diagnostic closure. Croskerry describes “Sutton’s slip” as a cognitive error that occurs when one considers only the obvious, for example, not recognizing and looking for the uncommon “zebra” diagnosis.²² Here, an alternative diagnosis is considered or generated but not pursued for various reasons such as physician fatigue, difficulty in accessing certain investigations, and cost and/or fear of traveling an unfamiliar diagnostic path. Finally, premature closure as discussed earlier can be hazardous by avoiding the verification process and/or the patient may be inappropriately labeled with a diagnosis.

The obvious concern regarding clinical errors is the resultant potential for increased patient morbidity and mortality. Beyond this concern of patient outcome are the issues of physician accountability and litigation. These external forces affect the way physicians make clinical decisions in their attempts to avoid error. Feinstein describes this risk aversion behavior as the “chagrin factor”—not a source of error in itself, but rather a result of worrying about making errors.²⁴ The obvious problems that arise with this approach is the inappropriate use of resources. Although some physicians believe that ordering more tests is good risk management, this view is unsubstantiated.²⁵

The degree to which chagrin plays a role in clinical decision making is likely related to the experience and personal traits of the physician. Pearson et al. examined physicians’ risk attitudes and their relationships to triage decisions in the evaluation of patients with chest pain in the ED.²⁶ Physicians identified as risk takers on a risk attitude questionnaire were significantly more likely to discharge patients with chest pain than those identified as risk avoiders. The patient populations and outcomes of these two groups were similar.

CONCLUSIONS

Clinical decision making in EM requires an approach that is sensitive to the unique environment.
of the ED. Emergency physicians frequently use an abbreviated form of the hypothetico-deductive model as a clinical decision-making strategy. However, they frequently seek to eliminate or discriminate rather than confirm competing hypotheses. Assessment of acuity takes precedence over diagnostic closure. The algorithm is a necessary clinical decision-making strategy used by the EP. It is most often used when the acuity of presentation precludes the use of the hypothetico-deductive model.

Nowhere else is diagnostic uncertainty more prevalent than in the ED. Emergency physicians must accept this as intrinsic to the practice of EM. The most common representation of this uncertainty is the diagnosis of unknown etiology. When used appropriately, a diagnosis of unknown etiology has utility in preventing inappropriate premature diagnostic closure.

Perhaps the most useful reason for examining clinical decision making is the insight that can be provided regarding clinical decision errors. The ED environment is fertile ground for such errors. Although faulty hypothesis generation is likely one of the most common etiologies of error, the inappropriate consideration of disease prevalence, anchoring, and vertical-line failure are important sources of error in EM. Since diagnostic closure is frequently not achieved or even sought in the ED, errors of faulty verification occur less frequently.

The study of medicine has traditionally focused on the transfer of knowledge. Despite changes in the methods of this transfer through the use of problem-based learning and evidence-based medicine, students and physicians are not traditionally aware of the cognitive processes used in clinical decision making. Although some may consider the study of clinical decision making an art, this does not preclude its value. However, there is a need to validate clinical decision making beyond “thoughts of how we think” and further develop it as a science through research and education.

References