

The Thinker's Guide  
to

# Clinical Reasoning

By  
Dr. David Hawkins  
Dr. Linda Elder  
Dr. Richard Paul

Based on  
*Critical Thinking Concepts and Tools*

The Foundation for Critical Thinking



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[www.criticalthinking.org](http://www.criticalthinking.org)

[cct@criticalthinking.org](mailto:cct@criticalthinking.org)

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# **The Thinker's Guide to Clinical Reasoning**



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## Introduction

### Why a Thinker's Guide to Clinical Reasoning?

Clinical reasoning can be defined as thinking through the various aspects of patient care to arrive at a reasonable decision regarding the prevention, diagnosis, or treatment of a clinical problem in a specific patient. Patient care includes history taking, conducting a physical exam, ordering laboratory tests and diagnostic procedures, designing safe and effective treatment regimens or preventive strategies, and providing patient education and counseling.

Obviously, the clinician should be well grounded in biomedical and clinical sciences and skillful at gathering clinical data from a patient before engaging in the process of clinical reasoning. This guide does not address the knowledge and skills required to competently gather and interpret clinical data. Rather, the guide is intended to help clinicians take the next step, which is determining the best course of action to take based on what is known or what can reasonably be hypothesized from clinical data. So, it isn't enough to have a strong background in the biomedical sciences or to possess excellent clinical knowledge, or to know how to conduct a history and physical exam on a patient, or even to know how to formulate a differential diagnosis given the signs, symptoms, and test results of a patient. In addition to all of this, there is still a need to think critically about all the important information pertaining to a particular case and to formulate or synthesize a rational plan of action. In short, clinical reasoning requires critical thinking skills, abilities and traits which are often not taught in schools and colleges for the health professions.

Skilled clinicians systematically analyze their thinking by targeting the elements of clinical reasoning and evaluate their thinking through application of intellectual standards to those elements. These clinicians also develop and routinely exhibit intellectual traits or dispositions of mind. When these foundations of critical thinking – the elements of reasoning, intellectual standards, and intellectual traits – are made explicit and deeply understood, the clinician has explicit intellectual tools useful for



examining, assessing and improving thought. This guide introduces the clinician to these foundations and offers examples of their application to the field.

It is important to note that there are numerous problems in clinical practice that go beyond the scope of this guide, including:

1. the mistakes in medical reasoning which lead to death or other adverse consequences.
2. the overspecialization within medical fields that often leads to fragmented care and lack of integration across specialities.
3. the overreliance of traditional medicine on prescription medications in dealing with medical problems rather than alternative potential therapies.
4. the general failure within traditional medicine to acknowledge and appropriately use effective alternative medical approaches (which is connected with the failure to integrate the best ideas within traditional medicine with the best ideas within alternative medicine).
5. the failure to emphasize prevention over "cure."
6. the medical decisions being determined primarily by the vested interests of clinicians.
7. the influence pharmaceutical companies have on prescribing habits.

This guide focuses on a framework for critical thinking relevant to all domains of human thought and is specifically focused on clinical reasoning. The suggestions and conclusions herein are consistent with the suggestions and conclusions found in the works of prominent thinkers in the clinical fields, including Joy Higgs, Mark Jones, Jerome Kassirer, John Wong, Richard Kopelman, Daniel Pesut, Joann Herman, Kathryn Montgo, Eileen Gambrill, Jerome Groopman and Milos Jenicek.

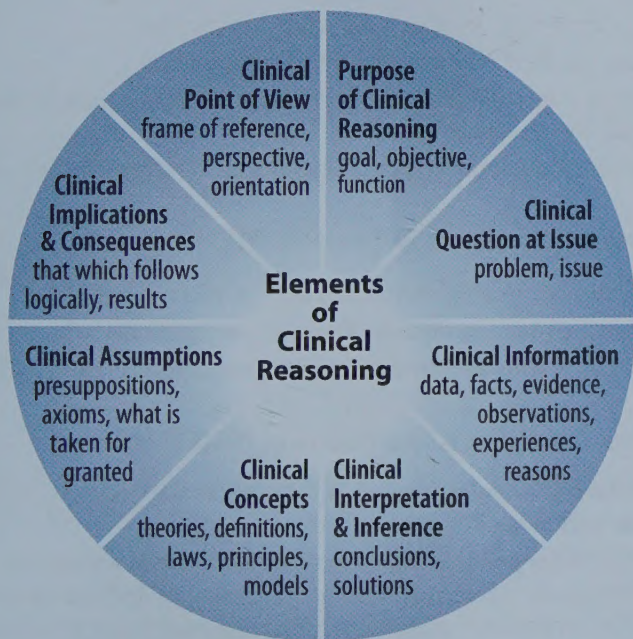
Though this guide includes some significant examples within the field of medicine, given its limited nature, it does not include the many field-specific contributions to clinical reasoning from medicine, nursing, pharmacy, dentistry, veterinary medicine, and other health related fields. Moreover, we are not attempting to provide specific procedures for clinical reasoning, but only broad principles that must be contextualized by the user. For exemplification purposes, we have focused primarily on diagnosis and treatment. The guide is intended to detail and exemplify clinical reasoning as a mode of thought. Thus the principles illuminated in it should be integrated within the context of clinical reasoning – for the purpose of both teaching and practice at all levels. Finally, due to its nature, we have not attempted to link the principles in this guide to current or classical philosophical orientations within general argumentation, reasoning and decision making.



## The Elements of Clinical Reasoning

The elements of clinical reasoning that appear in the diagram below provide the basis for analyzing the structures present in all thinking. *Whenever we think, we think for a purpose within a point of view based on assumptions leading to implications and consequences. We use concepts, ideas, and theories to interpret data, facts, and experiences in order to answer questions, solve problems, and resolve issues.*

Each of these structures has implications for the others. If you change your purpose, for example, you change your questions and problems. You are then forced to seek new information and data. And this changes the implications and consequences of your conclusions and decisions.



### Used With Sensitivity to Universal Intellectual Standards

Clarity → Accuracy → Depth → Breadth → Significance  
 Precision  
 Relevance  
 ↓  
 Fairness

## A Checklist for Clinical Reasoning

### 1) All clinical reasoning has a **PURPOSE**.

- Can you state your purpose clearly?
- What is the objective of your clinical reasoning?
- Does your reasoning focus throughout on your clinical goal?
- Is your clinical goal realistic?

### 2) All clinical reasoning is an attempt to figure something out, to settle some **QUESTION**, to solve some **PROBLEM**.

- What clinical question are you trying to answer?
- Are there other ways to think about the question?
- Can you divide the question into sub-questions?
- Is this a question that has one right answer or can there be more than one reasonable answer?
- Does this question require clinical judgment rather than facts alone?

### 3) All clinical reasoning is based on **ASSUMPTIONS**.

- What assumptions are you making? Are they justified?
- How are your assumptions shaping your point of view?
- Which of your assumptions might reasonably be questioned?

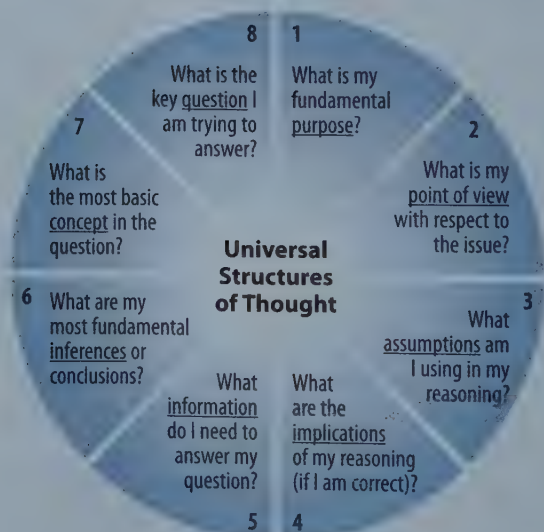
### 4) All clinical reasoning is done from some **POINT OF VIEW**.

- What is your point of view? What insights is it based on? What are its weaknesses?
- What other points of view should be considered in reasoning through this problem? What are the strengths and weaknesses of these viewpoints? Are you fairmindedly considering the insights behind these viewpoints?

## A Checklist for Clinical Reasoning (cont.)

- 5) **All clinical reasoning is based on DATA, INFORMATION, and EVIDENCE.**
  - To what extent is your reasoning supported by relevant data?
  - Do the data suggest explanations that differ from those you have given?
  - How clear, accurate, and relevant are the data to the clinical question at issue?
  - Have you gathered data sufficient to reach a valid conclusion?
  
- 6) **All clinical reasoning is expressed through, and shaped by, CONCEPTS and THEORIES.**
  - What key concepts and theories are guiding your clinical reasoning?
  - What alternative explanations might be possible, given these concepts and theories?
  - Are you clear and precise in using clinical concepts and theories in your reasoning?
  - Are you distorting ideas to fit your agenda?
  
- 7) **All clinical reasoning contains INFERENCES or INTERPRETATIONS by which we draw CONCLUSIONS and give meaning to data.**
  - To what extent do the data support your clinical conclusions?
  - Are your inferences consistent with each other?
  - Are there other reasonable inferences that should be considered?
  
- 8) **All clinical reasoning leads somewhere, that is, has IMPLICATIONS and CONSEQUENCES.**
  - What implications and consequences follow from your reasoning?
  - If we accept your line of reasoning, what implications or consequences are likely?
  - What other implications or consequences are possible or probable?

## To Analyze Thinking, Identify and Question its Elemental Structures



*Note:* When we understand the structures of thought, we ask important questions implied by these structures.

## Analyzing the Logic of a Clinical Case Through the Elements of Reasoning

A 53 year old man complains of severe pain in his left big toe for the past 2 days. The patient has a past medical history of two episodes of acute gouty arthritis in the past 3 months, hypertension for 10 years, and dyslipidemia. He is currently receiving a thiazide diuretic for his high blood pressure, atorvastatin for his high cholesterol, and one aspirin tablet daily to prevent heart attacks. Laboratory studies revealed a serum urate concentration of 10mg/dL and a very high urinary urate concentration. The patient's blood pressure is 130/80 mmHg. A positive diagnosis of acute gouty arthritis was confirmed by taking a sample of the patient's synovial fluid taken from the affected joint and examining it under a polarizing microscope.

### Purpose:

To treat the acute attack and to prevent recurrent attacks.

### Questions

1. What is the most effective way to treat this patient's acute attack?
2. What is the most effective way to prevent recurrent attacks in this patient?
3. What adjustments, if any, need to be made to this patient's other medications?

### Assumptions

1. Colchicine will not work in this case.
2. Baby aspirin will not significantly increase serum urate concentrations.
3. Traditional medicine has the best answers in a case like this, so we don't need to consider alternative therapies.

### Points of View

1. A conservative approach would be to treat the acute attack and discontinue the thiazide diuretic because it increases serum uric acid concentration and therefore the propensity for recurrent attacks.
2. A more aggressive approach would be to initiate preventive therapy irrespective of the decision to continue or discontinue the diuretic.

### Information

1. Either colchicine or a non-steroidal anti-inflammatory agent can be used to treat acute attacks.
2. Colchicine's effectiveness diminishes 48 hours after onset of pain.
3. Either probenecid or allopurinol can be used to prevent recurrent attacks.
4. Probenecid increases urinary uric acid excretion.
5. A further increase in urinary uric acid could cause the development of kidney stones.

6. Diuretics and adult doses of aspirin increase serum urate concentrations.
7. Other medicines that do not increase serum urate concentration can be used to control the patient's blood pressure.

### Concepts

1. Gout
  - acute gouty arthritis
  - recurrent gouty arthritis
  - nephrolithiasis
2. Hypertension
  - traditional approaches
  - alternative approaches
3. Heart Attack Prevention
  - low dose aspirin
  - cholesterol management



### Interpretation/Inference

1. The clinical data indicate a positive diagnosis of acute gouty arthritis.
2. Since the patient has a relatively high risk of recurrent events, preventive therapy with allopurinol should be initiated.
3. The patient's antihypertensive therapy should be switched from thiazide to another agent that will not increase serum urate concentration.
4. Baby aspirin should be continued since it is unlikely that a small dose of aspirin will increase serum urate substantially.

### Implications and Consequences

1. Failure to treat the acute attack with an agent that will be effective even after 24 hours of the onset of pain will result in the unnecessary continuation of severe pain.
2. By not initiating preventive therapy, there is a high likelihood that the patient will experience repeated attacks given his history and clinical condition.
3. If probenecid is used to prevent recurrent attacks, the patient will be placed at a high risk of developing kidney stones because probenecid increases uric acid excretion.

## Universal Intellectual Standards Essential to Sound Clinical Reasoning

Universal intellectual standards are standards which must be applied to thinking whenever one is evaluating the quality of reasoning about a problem, issue, or situation. To think critically one must have a command of these standards. While there are a number of universal standards, we focus here on some of the most significant:

### Clarity

Could you elaborate further on that point? Could you express that point in another way? Could you give me an illustration? Could you give me an example?

Clarity is a gateway standard. If a statement is unclear, we cannot determine whether it is accurate or relevant. In fact, we cannot tell anything about it (except that it is unclear) because we don't yet know what it is saying.

### Accuracy

Is that really true? How could we check that? How could we find out if that is true? What evidence is there to support the validity of your clinical thinking?

A statement can be clear but not accurate, as in "Most creatures with a spine weigh more than 300 pounds."

### Precision

Could you give me more details? Could you be more specific?

A statement can be both clear and accurate, but not precise, as in "The solution in the beaker is hot." (We don't know how hot it is.)

### Relevance

How is that connected to the question? How does that bear on the issue?

A statement can be clear, accurate, and precise, but not relevant to the question at issue. If a person who believed in astrology defended his/her view by saying "Many intelligent people believe in astrology," their defense would be clear, accurate, and sufficiently precise, but irrelevant to clinical reasoning.

### Depth

How does your answer address the complexities in the question? How are you taking into account the problems in the question? Are you dealing with the most significant factors?

A statement can be clear, accurate, precise, and relevant, but superficial (that is, lacks depth). For example, the statement "Just Say No," which is often used to

discourage children and teens from using drugs, is clear, accurate, precise, and relevant. Nevertheless, it lacks depth because it treats an extremely complex issue, the pervasive problem of drug use among young people, superficially. It fails to deal with the complexities of the issue.

### **Breadth**

Do we need to consider another point of view? Is there another way to look at this question? What would this look like from the point of view of a conflicting theory, hypothesis or conceptual scheme?

A line of reasoning may be clear, accurate, precise, relevant and deep, but lack breadth (as in a well-reasoned argument from either of two conflicting theories which ignores insights into the conflicting theory).

### **Logic**

Does this really make sense? Is this consistent with what we know about this issue or problem?

When we think, we bring a variety of thoughts together into some order. When the combination of thoughts is mutually supporting and makes sense in combination, the thinking is "logical." When the combination is not mutually supporting, is contradictory in some sense, or does not "make sense," the combination is "not logical." In clinical reasoning, new conceptual schemes become working hypotheses when we deduce from them logical consequences which can be tested by experiment. If many of such consequences are shown to be true, the theory (hypothesis) which implied them may itself be accepted as true.

### **Significance**

Is this the most important problem to consider? Is this the central idea to focus on? Which of these facts are most important?

When dealing with a complex issue it is essential to consider relevant variables. But some are more significant than others. The most significant variables should be considered first. Secondary relevant variables come next in order of importance.

### **Fairness**

Do I have a vested interest in this issue? Am I representing the viewpoints of others in a way that is fair and balanced?

We naturally think from our own perspective, from a point of view which tends to privilege our position. Fairness implies the treating of all relevant viewpoints alike without reference to one's own feelings or interests. Because we tend to be biased in favor of our own viewpoint, it is important to keep the standard of fairness at the forefront of our thinking. This is especially important when the situation may call on us to see things we don't want to see, or give something up that we want to hold onto.



**Clarity**

Could you elaborate further?  
Could you give me an example?  
Could you illustrate what you mean?

**Accuracy**

How could we check on that?  
How could we find out if that is true?  
How could we verify or test that?

**Precision**

Could you be more specific?  
Could you give me more details?  
Could you be more exact?

**Relevance**

How does that relate to the problem?  
How does that bear on the question?  
How does that help us with the issue?

**Depth**

What factors make this a difficult problem?  
What are some of the complexities of this question?  
What are some of the difficulties we need to deal with?

**Breadth**

Do we need to look at this from another perspective?  
Do we need to consider another point of view?  
Do we need to look at this in other ways?

**Logic**

Does all this make sense together?  
Are we taking a reasonable approach to the problem?  
Does what you say follow from the evidence?

**Significance**

Is this the most important problem to consider?  
Is this the central idea to focus on?  
Which of these facts are most important?

**Fairness**

Do I have any vested interest in this issue?  
Am I sympathetically representing the viewpoints of others?

# The Application of Clinical Reasoning to Patient Care

## History Taking

A careful history of a patient's presenting signs and symptoms, current medical conditions, previous surgeries, illnesses or medical problems, use of medications, vitamins, and supplements, lifestyle behaviors, and perceptions of health and disease is rarely achieved skillfully and comprehensively. One explanation for this is that clinicians feel rushed to see as many patients as they can, and so they conduct a cursory or abbreviated history. In some clinical settings, a rapid, highly focused history is appropriate, as is in the case when a patient presents to the emergency room complaining of severe chest pain. Another explanation, however, is that history taking is not always guided by careful, critical thinking. As each piece of information is gathered during history taking, the clinician should assess the information by asking the following types of questions:

1. Is the patient being *clear* and *accurate* in his or her description of what is or has taken place? Or, do I need to ask more questions to *clarify* what the patient is reporting?
2. Am I gathering the information *relevant* to figuring out the problem(s) being experienced by the patient?
3. What else do I need to know to identify more *precisely* what the problem or issue is or how to solve the problem?
4. As I listen to what the patient is reporting, what fundamental concepts do I need to think through to formulate a reasonable hypothesis (or draw an inference) as to what the problem might be?
5. If I think I know what the problem might be, how can I test my hypothesis? In other words, what laboratory studies and diagnostic procedures do I need to order?

Another important aspect of history taking is close observation. The body language of a patient is almost as important as what the patient articulates, or it may be irrelevant. Facial expressions, nervous tics, stroking a beard, scratching the head, leg swinging, leg pumping, repeated rubbing the ends of an arm rest, staring at the floor, wringing the hands may communicate the state of mind, nervousness, anxiety, fear, sadness, exaggeration, and even deceit or untruthfulness. The clinician making observations of body language draws certain inferences that require critical inquiry. In some instances what is being observed merely reflects a patient's timidity or uneasiness due to the circumstances and surroundings. In such a case as this, it is, of course, important to help the patient feel more relaxed

and comfortable so that the history the patient gives is clear, accurate, and relevant. In other instances, the clinician infers that the outward behavior of the patient is indicative of depression, anxiety, panic disorder, hypochondria, or even drug-seeking behavior. The ability to make good clinical observations comes with years of experience and reflective thinking. In any case, the clinician must be careful not to infer beyond what is actually implied. And in many cases, what is “meant by” body language cannot be accurately inferred.

History taking is guided by hypotheses formulated as the history unfolds. Before formulating a final conclusion, initial hypotheses must be carefully considered and thought through. An initial hypothesis is based on the relevant information: patient's age, gender, known risk factors, and chief complaint (the reason the patient is seeking medical attention), and so forth. Consider, for example, a 40 year old woman who complains of shortness of breath and who is on birth control pills, has a history of heavy menses, and smokes. This initial information would generate possible hypotheses of anemia, pulmonary embolus, asthma, lung cancer, and heart disease.

To test a hypothesis, a series of questions are posed either to elicit information that supports or refutes the hypothesis. For example, if a patient complains of chest pain, the clinician will ask a series of questions to determine the likelihood that the chest pain is due to coronary artery disease (a reasonable hypothesis based on the patient's symptom or chief complaint). These questions would be directed at finding out the nature of the pain (sharp, dull, squeezing), whether or not the pain radiates (up into the jaw, down the left arm), the duration of the pain, what provokes the pain, and what relieves the pain. If the answers to these questions do not support the hypothesis that the patient's chest pain is due to coronary artery disease, the line of questioning shifts toward identifying other possible causes of chest pain, such as indigestion, gallbladder problems, pulmonary embolism, rib inflammation, or even anxiety.

The purpose of taking a history is to elicit accurate pieces of information that contribute to the problem-solving process. After considering information obtained from questioning a patient about his or her symptoms, the clinician draws either an inference that the patient has a specific problem or has one of several possible problems. In the latter case, the physical exam and various diagnostic procedures will be used to narrow the list or determine the actual problem. Every step in this



process requires careful clinical reasoning. Alternative inferences (of disease) must be entertained. Assumptions regarding the patient's ability to articulate accurately the history of illness have to be examined along with assumptions made based on patient demographics and other known medical problems. The implications of ordering certain diagnostic procedures have to be weighed, the possible consequences of treating, or failing to treat, appropriately the underlying problem have to be considered. And the patient's point of view must be ascertained.

If it were possible to quantitate the relative importance of each aspect of making a diagnosis, history taking would probably be in the range of 70% to 80%.

## Physical Examination

After history taking comes the physical examination. The clinician is looking for physical signs either to confirm or rule out inferences made while taking the patient's medical history. The approach to the physical examination can be thorough (i.e., a complete physical), in which case unexpected findings and additional problems may be identified, or highly focused, where the intent is to search for findings that either confirm or rule out clinical impressions. In either case, careful, analytical thinking is necessary in order to reach an accurate diagnosis or to construct a differential diagnosis (a list of possible clinical problems), which then requires further inquiry. Even before one begins to conduct a physical examination, it is imperative to run through the elements of thought with a series of questions. For example,

1. What is the purpose of this physical examination? Is it to confirm or rule out impressions or is it to determine if problems may be contributing to or coexisting with the presumptive underlying problem?
2. What specific questions need to be addressed while conducting the physical examination?
3. What information do I need to gather in order to answer the key questions?
4. What assumptions am I making even before I begin the physical examination (in other words, what am I taking for granted)? Do these assumptions need to be questioned for justifiability?
5. What basic pathophysiologic concepts do I need to use in my thinking as I conduct the physical exam?

Then during and after the physical examination, it is important to grapple with questions like:

1. What inferences do I draw from the physical examination? How do these relate to my prior impressions or inferences (based on the medical history)?

2. If I reason to conclusion X, what implications are likely to follow? If I reason to conclusion Y, what implications are likely to follow?
3. Am I certain enough of my tentative conclusion (diagnosis) to start treatment now or should I order additional tests or procedures to gather more information before making a final decision? What are the *important consequences* of starting treatment if the diagnosis is correct? What are the *important consequences* of starting treatment if the diagnosis is incorrect? What are the consequences of delaying treatment if the presumptive diagnosis is correct?
4. What additional information or data are needed to make an *accurate* clinical decision?
5. What points of view are being considered in deciding what exactly needs to be done to reach a final clinical decision (inference) in this case? Am I missing any *important relevant viewpoints*?
6. Am I missing *important relevant information* such as the patient's age, social status, family support, financial capability, patient's input?
7. Do I need to refer this patient to a specialist for a more comprehensive and skillful work-up?

The physical examination includes four major components: inspection, palpitation, percussion, and auscultation. The information obtained from conducting each part of the physical must then be assessed using intellectual standards. The following questions are examples of applying intellectual standards to the physical examination:

1. Have I been *accurate* in observing physical signs that may indicate the presence of a particular condition or several possible conditions?
2. Have I gathered all the relevant information for making a diagnosis?
3. Is my auscultatory technique *precise* enough to detect an abnormality if abnormality is actually present?
4. Have I been *thorough* enough to identify abnormalities, or is there something more that needs to be done to be certain?
5. Have I *clearly* stated the findings I made during the physical exam?
6. Have I documented all the *significant* physical findings?
7. Are the findings from the physical examination *consistent* with the impressions formed during the history taking? Is it all making sense? Are my conclusions *logical*?

## Ordering Laboratory Tests and Diagnostic Procedures

Based on the history and physical examination, the clinician constructs a list of possible diagnoses (if the patient is presenting with a new sign or symptom), or an objective assessment and plan (if the patient is returning for a follow-up visit for an existing clinical problem). Clinical laboratory tests are usually ordered to strengthen or confirm the assessment of the patient's condition and occasionally to arrive at a particular diagnosis. For example, if anemia is suspected based on the patient's history and physical examination, a complete blood count is obtained to determine if indeed the patient suffers from some kind of anemia as evidenced by a low hemoglobin and hematocrit. Other tests would then be ordered to ascertain what specific type of anemia the patient has developed. For example, a low serum iron and elevated iron binding capacity would indicate an iron deficiency anemia as opposed to a folic acid deficiency anemia.

Diagnostic tests are ordered to confirm or rule-out a particular diagnosis. Before choosing a diagnostic test, the clinician needs to address the following questions:

1. What assumptions are being made regarding the need to pursue a particular diagnosis or the need for more than one test to confirm a specific diagnosis? (What am I taking for granted in this case?)
2. What is the purpose of the diagnostic test? Is it to confirm a presumptive diagnosis or is it to rule-out a diagnosis in order to narrow the list of possible causes of the patient's signs and symptoms?
3. If the purpose is to confirm a diagnosis, what is the best diagnostic test?
4. If the purpose is to rule-out a diagnosis, what is the best diagnostic test?
5. What information do I have regarding the sensitivity and specificity of the diagnostic test that I have chosen? In other words, how *accurate* is the test in detecting disease if the disease in question is present (sensitivity)? And how certain can I be that the patient does not have the disease in question if the test is negative (specificity)?
6. What are the false-positive and false-negative rates associated with the diagnostic test?
7. What are the implications and consequences of a true-positive test, a false-positive test, or a false-negative test?
8. And, finally, how does my perspective on what to do about a positive or negative diagnostic test differ or agree with the patient's perspective? For example, if the patient has made up her mind that treatment of the disease is not worth the cost or possible side effects, or if the patient has decided to aggressively pursue treatment regardless of the cost or consequences, then either I have to change my perspective or try to convince the patient to change hers.

## Diagnosis

As stated earlier, the diagnosis of a clinical problem can often be made on the basis of the patient's history and/or physical exam. However, in most cases a diagnostic test will be needed either to confirm or rule out a particular diagnosis. It is therefore imperative to understand the properties of a diagnostic test to know how to interpret a test result.

*The fixed properties of a diagnostic test relate to its sensitivity and specificity.*

		Disease	
		Present	Absent
Diagnostic Test	Positive	True Positive	False Positive
	Negative	False Negative	True Negative

The sensitivity of a diagnostic test is the proportion of subjects with the disease who have a positive test for the disease.  $\text{Sensitivity} = \frac{\text{True Positive Rate}}{\text{True Positive Rate} + \text{False Negative Rate}}$ . A highly sensitive diagnostic test is used when there is an important penalty for missing a disease or to rule out a disease when the test is negative, since a negative test would be unlikely in an individual with the disease.

The specificity of a diagnostic test is the proportion of subjects without the disease who have a negative test.  $\text{Specificity} = \frac{\text{True Negative Rate}}{\text{True Negative Rate} + \text{False Positive Rate}}$ . A highly specific test is used when a false positive test can harm a patient physically, emotionally, or financially or to rule in a disease when the result is positive since, a positive test would be unlikely in an individual without the disease.

Once the results of a diagnostic test are known, the question arises as to how predictive are the results. In other words, if the test is positive, what is the probability that the diagnosis in question is present (i.e., the positive predictive value)? And, if the test is negative, what is the probability that the disease in question is absent (i.e., the negative predictive value)?

The predictive value of a test depends on its sensitivity and specificity.

The more sensitive a test, the better will be its negative predictive value, i.e., the more confident one can be that a patient with a negative test does not have the disease.

The more specific a test, the better will be its positive predictive value, i.e., the more confident one can be that a patient with a positive test has the disease.

The positive predictive value = True Positive Rate / True Positive + False Positive Rate. The negative predictive value = True Negative Rate / True Negative + False Negative Rate.

While sensitivity and specificity are fixed properties of a diagnostic test, predictive values are influenced by prevalence. As prevalence of a disease approaches 0%, the positive predictive value approaches 0%. And, as prevalence of a disease approaches 100%, the negative predictive value approaches 0%.

Given a diagnostic test that is 80% sensitive and 90% specific, what is its predictive value when prevalence is 50% in 1000 patients tested?

		Disease		
		Present	Absent	
Diagnostic Test	Positive	400 (TP)	50 (FP)	
	Negative	100 (FN)	450 (TN)	
		500	500	1000

The positive predictive value =  $400/400+50$  or 90% and the negative predictive value =  $450/450+100$  or 82%. If the prevalence was 10% instead of 50%, then the positive predictive value would drop to 47% and the negative predictive value would increase to 98%.

Another useful property of a diagnostic test is the likelihood ratio. The likelihood ratio expresses the odds that a given level of a diagnostic test would be observed in a patient with (as opposed to one without) the presumptive disorder.

The likelihood ratio for a positive test = TP rate/FP rate (Sensitivity/1-specificity). The likelihood ratio for a negative test = FN rate/TN rate (1-sensitivity/specificity)

The true positive rate =  $TP/TP+FN$ ; the false positive rate =  $FP/FP+TN$ .

The false negative rate =  $FN/FN+TP$ ; the true negative rate =  $TN/TN+FP$ .

Likelihood ratios (LR) can be used to convert pretest odds to posttest odds by the equation: pretest odds X LR = posttest odds, where odds = the probability of event / (1-probability of event). To convert odds back to probability, probability = odds/1+odds.



To illustrate the utility of likelihood ratios consider the following case scenario:

A 45 y/o woman with a 1 month history of chest pain has a pretest probability of coronary artery disease of 1% (pretest odds = .01/.99 or .01:1) based on previously validated sets of clinical data. A careful history reveals that the chest pain is substernal, radiates down the left arm, is brought on by exertion, and is relieved by rest.

Given this particular history, the estimated likelihood ratio for coronary artery disease in a woman is known to be 120 (that is to say that this history is 120 times more likely to come from a female patient with coronary artery disease than from a woman without coronary heart disease). This then raises her probability for coronary artery disease from 1% to 55% (posttest odds = .01:1 X 120 = 1.2:1; probability of coronary artery disease =  $1.2/2.2 = 55\%$ ).

She then undergoes a treadmill exercise tolerance test (ETT) which shows a 2.2mm ST segment depression in several chest leads on her EKG. The likelihood ratio of this ETT result in a woman has been calculated to be 11. Now her probability for coronary artery disease rises to 93% (posttest odds =  $1.2 \times 11 = 13.2:1$ ; probability of coronary artery disease =  $13.2/14.2 = 93\%$ ). A more detailed discussion on the diagnostic test can be found in *Clinical Epidemiology: The Essentials*, 4th edition by Robert Fletcher and Suzanne Fletcher.

## Treatment

Once a diagnosis has been made, the next step in clinical care is to decide what if anything will be used to treat the problem. Again, the same elements of reasoning must be applied to the case. The following checklist for clinical reasoning can be used:

1. What is the explicit purpose of treatment? Is it to bring about a cure or prescribe palliative therapy, such as alleviating pain in a patient with incurable cancer? Or, is it needed to control a clinical abnormality like high blood pressure or prevent complications of a disease? Is the purpose of treatment to slow down or stop disease progression or simply to manage the disease to alleviate symptoms?
2. Given alternative ways to treat the patient's condition, which treatment is the most effective as indicated by evidence-based information and data? Which treatment is associated with the least number of side effects? Which treatments may be contraindicated (i.e., irrelevant) given the patient's underlying physiologic condition and concomitant medical problems? Are some alternative treatments more cost-effective than others, and how *accurate* are the data for making this judgment?
3. Have I identified and do I clearly understand the relevant pathophysiologic concepts of the disease. Can I explain how alternative therapies will interact

with underlying pathophysiologic mechanisms to produce a desired and optimal therapeutic outcome?

4. What will be the consequences of implementing therapy with a particular intervention? Is it possible that treatment will do more harm than good? How long should treatment be continued to achieve the best possible results? What are likely consequences if the patient does not adhere to the prescribed regimen? Will the new treatment interact with an existing therapy in such a way as to cause significant harm to the patient?
5. How will I know if the treatment is safe and effective? What parameters should be used to assess treatment outcomes? What variables should be monitored to identify or prevent adverse treatment effects? What should be the starting point for treatment and on what bases should adjustments be made?
6. What assumptions am I making about the desired treatment outcome? Are there possible differences in treatment outcomes based on age, race, gender, genetics, or underlying physiologic and pathophysiologic characteristics of the patient?
7. From whose perspective(s) are treatment decisions being made? What are the patient's perceptions of their illness and the proposed treatment? How will that affect compliance with the medical regimen and outcomes? What strategy needs to be employed to achieve proper understanding of the illness, treatment, and good adherence behavior? What can be done to help the patient who may not be able to afford the treatment?



example, I might ask:

Am I *clear* on just what the problem is and the alternative solutions? Or, do I need to define the problem more *precisely* and further explore the evidence in support of one treatment over another?

How *precisely* does the treatment target the problem or how likely is the treatment to favorably alter the underlying pathophysiologic mechanisms of the disease?

How can I ensure that this treatment regimen is the most *logical* considering the severity of the patient's problem, the need to make adjustments for age, physiologic abnormalities or concomitant conditions?

These are just some of the questions the clinician should grapple with. The elements of reasoning help guide the thinking by formulating appropriate questions. Similarly, intellectual standards can be targeted to discipline one's clinical reasoning. For

How *relevant* is the treatment given what is known about the patient's physiologic and pathophysiologic condition, prognosis, and level of commitment and motivation?

What are some of the *complexities* of the treatment that need to be considered? Have we dealt with the problem and treatment in sufficient *detail* to ensure optimal results?

Do we need to consider any other *relevant points of view* in the management of the patient? In other words, should we refer the patient to a specialist for re-evaluation and consultation?

Does the proposed treatment make sense (is it *logical*?) given the severity of the patient's illness, prognosis, likelihood of developing complications, and natural history of the illness?

How *significant* is the problem? Is it self-limiting? Can it lead to further morbidity or mortality?

Am I recommending treatment based on good medical ethics and reasoning? Or am I being influenced by outside forces or my own particular bias or financial gain?

Treatment decisions are made on the basis of both scientific evidence and logic. In some cases the decision will be to avoid treatment, either because there is no effective treatment for the disease, treating the disease may cause more harm than good, the disease is self-limiting and doesn't require intervention, or the seriousness of the disease does not warrant treatment. In the latter case, it may be more prudent to wait until the disease progresses before initiating therapy. Whatever decision is made, it should be supported by good clinical evidence that treatment is efficacious, safe and effective, and it should make sense given relevant patient variables and the underlying pathophysiologic condition of the patient.

The efficacy and safety of a particular treatment is best determined by the evidence obtained from a randomized controlled trial (RCT). A RCT is an investigation in which groups of individuals are randomly assigned to receive an experimental intervention or a control intervention (placebo or standard therapy). Patient selection criteria and proper randomization help achieve comparability between the two groups. To be properly randomized, each subject must have an equal chance of being assigned to the experimental group or control group. Subjects are followed prospectively over a finite period of time during which specific outcomes are measured with equal intensity in both groups. Differences in outcome are evaluated by appropriate statistical tests to determine significant differences. It is also important to assess any clinically significant differences irrespective of statistical significance. An inadequate sample size may explain why no statistical difference was observed even when a clinically relevant difference between the two treatments occurs.



As mentioned, a RCT is used to determine whether or not a particular treatment works compared to either a placebo (inert substance) or standard treatment. However, the subjects who participate in RCTs are not always representative of all patients to whom a treatment might be administered. Eligibility criteria for patients in a RCT are usually designed to achieve homogeneous groups of patients who are healthy, except for the condition being treated, and who are unlikely to experience an adverse effect as a result of other underlying co-morbid diseases or physiologic impairments. Therefore, clinical studies designed to measure the therapeutic effectiveness of alternative treatments are also needed to make sound clinical judgments regarding the treatment of individual patients. These studies answer the question: Does the treatment work compared to alternative treatments in patients who may or may not have co-morbid diseases and compromised physiologic conditions, such as renal function impairment? In other words, will the treatment work in normal practice (as opposed to does it work under highly controlled settings)?

In addition to investigating the evidence of a treatment's safety, efficacy, and effectiveness, there is also a need to determine the logic of a given treatment based on the underlying pathophysiology of the illness or disease and the various mechanisms by which treatment produces either positive results or adverse events. This type of critical inquiry integrates what we know about the cause and effects of a clinical problem with what we know about the benefits and risks of treatment.

To illustrate this type of clinical reasoning, consider a patient who presents for the first time with a diagnosis of type 2 diabetes mellitus. When this patient is seen by her clinician she is exhibiting all the signs and symptoms of poorly controlled diabetes and is found to have a fasting blood sugar of 210 mg/dL and hemoglobin A-1C level of 10%. We know in a patient like this there are two underlying pathophysiologic mechanisms that are working in tandem. One causes impaired insulin secretion and the other causes decreased insulin sensitivity. Among the oral agents used to treat type 2 diabetes mellitus are sulfonylureas that increase insulin secretion and metformin and the glitazones that increase insulin sensitivity. In order to effectively manage this patient's diabetes, combination therapy (a sulfonylurea plus metformin or a glitazone) would be indicated. That takes care of the benefit side of the treatment equation, but what about the risk side? If the patient also has impaired kidney function, then the clinician should avoid the use of metformin since it may lead to the development of lactic acidosis which may be fatal.

For more information on how to apply scientific evidence to treatment decision-making, we refer you to *Evidence-based Medicine: How to Practice and Teach EMB*, 3rd edition by Sharon Straus, W. Scott Richardson, Paul Glasziou, and R. Bryan Haynes.

## Reasoning Through a Clinical Case

A 51 year old man complains of coughing up blood, shortness of breath, and difficulty in breathing. He first noticed these symptoms about 2 months ago. He smokes one pack of cigarettes per day and was told that his blood pressure was a "little high." He is otherwise well and takes no medications, but he is worried about his health. His father had a heart attack and died at the age of 52. A complete physical examination is normal except for a blood pressure of 150/96. His pre-clinic blood work was also normal including a serum cholesterol of 180mg/dL and a fasting blood glucose of 100mg/dL.

As you think about this patient, what questions come to your mind that, when effectively answered, enable you to better understand the patient's condition and how to approach the treatment of this patient?

### Consider these possible questions:

1. What is the probability that this patient has lung cancer?
2. What diagnostic tests would provide the greatest utility in ruling in or ruling out cancer?
3. How likely is it that this patient's condition will worsen?
4. What are this patient's risk factors for lung cancer?
5. How long can this patient expect to live if he in fact has lung cancer?
6. What would be the best course of action to take in treating this patient?
7. Will risk factor reduction and treatment of his disease improve the quality and quantity of his life?
8. What caused this patient to develop his condition?

Important questions such as these enable the clinician to think through relevant issues like the diagnosis, risk factors, prognosis, treatment, prevention, and causation of disease and what can be done to treat or prevent disease or reduce the likelihood of disease complications.

## Analyzing the Logic of an Article, Essay or Chapter

One important way to understand an essay, article or chapter is through analyzing the parts of the author's reasoning. Once you have done this, you can evaluate the author's reasoning using intellectual standards (see pages 11-13). Here is a template to follow:

- 1) The main **purpose** of this article is \_\_\_\_\_.  
(Here you are trying to state, as accurately as possible, the author's intent in writing the article. What was the author trying to accomplish?)
- 2) The key **question** that the author is addressing is \_\_\_\_\_.  
(Your goal is to figure out the key question that was in the mind of the author when he/she wrote the article. What was the key question addressed in the article?)
- 3) The most important **information** in this article is \_\_\_\_\_.  
(You want to identify the key information the author used, or presupposed, in the article to support his/her main arguments. Here you are looking for facts, experiences, and/or data the author is using to support his/her conclusions.)
- 4) The main **inferences** in this article are \_\_\_\_\_.  
(You want to identify the most important conclusions the author comes to and presents in the article).
- 5) The key **concept(s)** I need to understand in this article is (are) \_\_\_\_\_.  
By these concepts the author means \_\_\_\_\_.  
(To identify these ideas, ask yourself: What are the most important ideas that you would have to know to understand the author's line of reasoning? Then briefly elaborate what the author means by these ideas.)

- 6) The main **assumption**(s) underlying the author's thinking is (are) \_\_\_\_\_ (Ask yourself: What is the author taking for granted [that might be questioned]? The assumptions are generalizations that the author does not think he/she has to defend in the context of writing the article, and they are usually unstated. This is where the author's thinking logically begins.)
- 7a) If we accept this line of reasoning (completely or partially), the **implications** are \_\_\_\_\_. (What consequences are likely to follow if people take the author's line of reasoning seriously? Here you are to pursue the logical implications of the author's position. You should include implications that the author states, and also those that the author does not state.)
- 7b) If we fail to accept this line of reasoning, the **implications** are \_\_\_\_\_. (What consequences are likely to follow if people ignore the author's reasoning?)
- 8) The main **point(s) of view** presented in this article is (are) \_\_\_\_\_. (The main question you are trying to answer here is: What is the author looking at, and how is he/she seeing it? For example, in this thinker's guide we are looking at clinical reasoning and seeing it as requiring one to understand and routinely apply the elements of reasoning when thinking through clinical problems and issues).

If you understand these structures as they interrelate in an article, essay or chapter, you should be able to empathically think within the author's reasoning. These are the eight basic structures that define all reasoning, the essential elements of thought.

## Analyzing the Logic of an Article: An Example

On pp. 30-31 you will find an analysis of the following brief article. Use the template on pp. 26-27 to work through the logic of this article before reading our specimen analysis.

### **Drug-Eluting versus Bare Metal Stents for the Treatment of Coronary Artery Stenosis\***

Two drug-eluting stents were approved by the FDA in 2003 for use in patients with coronary artery disease. Before drug-eluting stents were available, bare metal stents were used to correct for coronary artery stenosis. By the end of 2004, drug-eluting stents were used in nearly 80% of patients.

Initial approval of the two drug-eluting stents was based on the results of randomized, controlled trials that showed superiority of drug-eluting stents over bare metal stents up to 1 year after implantation. Shortly after drug-eluting stents were approved, reports of late stent thrombosis began to appear. This complication can lead to restenosis, which may result in myocardial infarction or even death.

In 2006, the results of a large study suggested that between 7 and 18 months after implantation, the rates of nonfatal myocardial infarction, death from cardiac causes, and angiographically

documented stent thrombosis were higher with drug-eluting stents than with bare metal stents. Over the next 6 months, the two manufacturers of the drug-eluting stents issued 19 press releases touting the effectiveness of their devices and never mentioned the potential risk of late thrombosis.

Other studies presented conflicting results, some showing an increased risk of death or myocardial infarction with drug-eluting stents and others showing no difference in mortality between patients with drug-eluting stents and bare metal stents.

Upon further investigation into these studies, two important factors emerged as possible explanations for the conflicting results including differences in the characteristics of patients and coronary lesions. Drug-eluting stents were approved for use in patients with newly diagnosed coronary lesions and without additional serious medical conditions, like those studied in



the clinical trials that led to FDA approval. However, since FDA approval was granted, more than 60% of drug-eluting stents have been implanted in patients with complex conditions (such as multi-vessel disease or acute myocardial infarction) or with complex lesions. These should be considered as off-label use.

On-label use of drug-eluting stents is associated with a persistent, long-term (>3year) reduction in the need for repeated revascularization (another stent, angioplasty, or clot dissolving therapy), without increasing the rates of mortality or myocardial infarction. Therefore, the risk of thrombosis associated with drug-eluting stents does not outweigh their advantages over bear metal stents in reducing the

rate of repeated revascularization procedures.

On the other hand, off-label use of drug-eluting stents is associated with increased risk of both early and late stent thrombosis, as well as death and myocardial infarction. For this reason, patients who receive drug-eluting stents should be placed on extended (at least 12 months) antiplatelet therapy as an added measure of protection against stent thrombosis. More studies are needed to determine if extended antiplatelet therapy will improve the overall outcome of drug-eluting stents in patients with multi-vessel disease or concomitant serious medical conditions.

*(\* Adapted from two articles that appeared in the New England Journal of Medicine, March 2007, pages 981-987)*



## The Logic of the Article on Stents

**Purpose:** To address the safety and efficacy of drug eluting stents (in comparison with bare metal stents) in the treatment of coronary artery disease; to illuminate why drug eluting stents (though superior to BMS) may lead to thrombosis in patients with coronary artery disease; to suggest a practical intervention strategy which will reduce risk in complex cases.

**Question:** What are the actual risks in using DES and how can they be minimized?

### Information:

1. "Initial approval of the two drug-eluting stents was based on the results of randomized, controlled trials that showed superiority of drug-eluting stents over bare metal stents up to 1 year after implantation."
2. "By the end of 2004, drug-eluting stents were used in 80% of patients."
3. After FDA approval, a large study indicated that the rates of MI, death from cardiac causes, and stent thrombosis were higher with drug-eluting stents.
4. Other studies suggested that long-term mortality did not differ between drug-eluting and bare metal stents.
5. Late thrombosis in patients with DES occurs primarily in patients with complicated lesions.
6. "On-label use of drug-eluting stents is associated with persistent, long-term reduction in the need for repeated revascularization...without increasing the rates of mortality or myocardial infarction."

### Concepts:

1. Drug-eluting stents
2. Bare metal stents
3. Coronary artery disease (CAD)
4. Thrombosis
5. Anti-platelet therapy

### Assumptions:

1. Clinical professionals need to take into account the overall health of a patient before deciding on treatment options.
2. When we identify problems in treatment options, we should search out the underlying causes.



3. The only real options for effectively treating coronary artery stenosis is through using drug-eluting or bare metal stents.
4. Antiplatelet therapy is generally useful in reducing risk of stent thrombosis.
5. Medical treatments should be used in accordance with their FDA approval.

**Inferences:**

1. Drug eluting stents are superior to bare metal stents in stable patients with non-complex coronary lesions.
2. Differences in types of patients in the randomized trials and post-FDA approval studies may explain the conflicting results. The latter group tended to have more advanced and more complex disease.
3. The use of stents off label (e.g., in patients with complex conditions such as multi-vessel disease) affects the performance of drug-eluting stents.
4. The risk of thrombosis associated with drug-eluting stents does not outweigh their advantages over bare metal stents in reducing the rates of repeated revascularization procedures.

**Implications:**

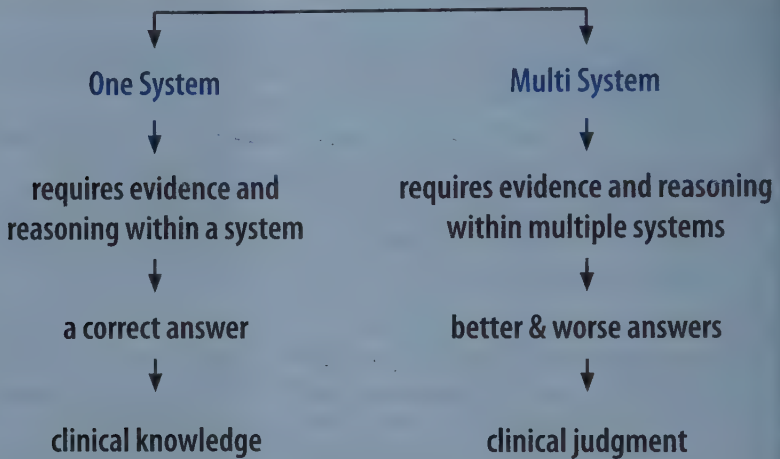
1. If I accept the logic of the author, I will most likely use drug-eluted stents in patients with coronary artery disease, but will combine it with antiplatelet therapy as a precautionary measure (especially in complex cases). I will also realize that more studies are needed to determine whether the combined DES/antiplatelet therapy adequately protects against stent thrombosis.
2. If I choose not to accept the argument or if I believe that the question has not been adequately addressed, I may seek additional information about this issue, or I might use drug-eluted stents without the antiplatelet therapy (which may cause serious problems in complex coronary cases), or I might decide to use bare metal stents instead, which have their own set of implications.

**Point of view:**

1. The author is looking at the research on drug-eluted stents as pointing to the need for an intervening (antiplatelet) therapy for maximizing efficacy and minimizing risk (especially in complex cases). The author is also seeing the need for further research on the question of whether antiplatelet intervention can in fact significantly reduce negative effects of drug-eluted stents.

## Two Kinds of Clinical Questions

In approaching a question, it is helpful to determine the kind of system to which it belongs. Is it a question with one definitive answer? Alternatively, does the question require us to consider competing answers or even competing approaches to either solution or conceptualization?



**Questions of Procedure** (established system)—These include questions with an established procedure or method for finding the answer. These questions are settled by facts, by definition, or both. These kinds of questions might be answered from a handbook or experimental results from a clinical trial.

Examples include:

- What evidence-based guidelines can be used to decide how to specifically treat this patient?
- What diagnostic test has been shown to provide the best sensitivity and specificity for making an accurate diagnosis?
- What is the most accurate instrument I can use to measure blood pressure?
- What steps can be taken to reduce the risk of heart disease in a 60 year old man who is obese and smokes cigarettes?





**Questions of Judgment** (conflicting systems)—These are questions requiring reasoning, but with more than one arguable answer, questions that make sense to debate, questions with better-or-worse answers (well-supported and reasoned or poorly-supported and/or poorly-reasoned answers). Here we are seeking the best answer within a range of possibilities. We evaluate answers to such questions using universal intellectual

standards such as breadth, depth, logicalness, and so forth. Some of the most important clinical questions are conflicting-system questions (for example, those questions with an ethical dimension). Answers to these questions depend heavily on clinical experience and expertise.

Examples include:

- Given the possible alternative treatments, which would be the best to use in this particular patient?
- What course of action should be taken for this patient who has no health insurance?
- What would be the most cost-effective way to determine if this patient has the disease I suspect?
- Should this patient undergo surgery for his condition or should we wait and see how the disease progresses?



## Analyzing & Assessing Clinical Research

**Use this template to assess the quality of any clinical research project or paper.**

- 1) All clinical research has a fundamental **PURPOSE** and goal.
  - Research purposes and goals should be clearly stated.
  - Related purposes should be explicitly distinguished.
  - All segments of the research should be relevant to the purpose.
  - All research purposes should be realistic and significant.
- 2) All clinical research addresses a fundamental **QUESTION**, problem or issue.
  - The fundamental question at issue should be clearly and precisely stated.
  - Related questions should be articulated and distinguished.
  - All segments of the research should be relevant to the central question.
  - All research questions should be realistic and significant.
  - All research questions should define clearly stated intellectual tasks that, being fulfilled, settle the questions.
- 3) All clinical research identifies data, **INFORMATION**, and evidence relevant to its fundamental question and purpose.
  - All information used should be clear, accurate, and relevant to the fundamental question at issue.
  - Information gathered must be sufficient to settle the question at issue.
  - Information contrary to the main conclusions of the research should be explained.
- 4) All clinical research contains **INFERENCES** or interpretations by which conclusions are drawn.
  - All conclusions should be clear, accurate, and relevant to the key question at issue.
  - Conclusions drawn should not go beyond what the data imply.
  - Conclusions should be consistent and reconcile discrepancies in the data.
  - Conclusions should explain how the key questions at issue have been settled.
- 5) All clinical research is conducted from some **POINT OF VIEW** or frame of reference.
  - All points of view in the research should be identified.
  - Objections from competing points of view should be identified and fairly addressed.
- 6) All clinical research is based on **ASSUMPTIONS**.
  - Clearly identify and assess major assumptions in the research.
  - Explain how the assumptions shape the research point of view.
- 7) All clinical research is expressed through, and shaped by, **CONCEPTS** and ideas.
  - Assess for clarity the key concepts in the research.
  - Assess the significance of the key concepts in the research.
- 8) All clinical research leads somewhere (i.e., have **IMPLICATIONS** and consequences).
  - Trace the implications and consequences that follow from the research.
  - Search for negative as well as positive implications.
  - Consider all significant implications and consequences.

## Purpose

(All reasoning has a purpose.)

**Primary Standards:** (1) Clarity (2) Significance (3) Achievability  
(4) Consistency (5) Justifiability

**Common Problems:** (1) Unclear (2) Trivial (3) Unrealistic  
(4) Contradictory (5) Unfair

**Principle:** To reason well, you must clearly understand your purpose, and your purpose must be reasonable and fair.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Take the time to state their purpose clearly.	Are often unclear about their central purpose.	Have I made the purpose of my reasoning clear? What exactly am I trying to achieve? Have I stated the purpose in several ways to clarify it?
Distinguish one's purpose from related purposes	Oscillate between different, sometimes contradictory purposes.	What different purposes do I have in mind? How do I see them as related? Am I going off in somewhat different directions? How can I reconcile these contradictory purposes?
Periodically remind themselves of their purpose to determine whether they are straying from it.	Lose track of their fundamental object or goal	In writing this proposal, do I seem to be wandering from my purpose? How do my third and fourth paragraph relate to my central goal?
Adopt realistic purposes and goals.	Adopt unrealistic purposes and set unrealistic goals.	Am I trying to accomplish too much in this project?
Choose significant purposes and goals.	Adopt trivial purposes and goals as if they were significant.	What is the significance of pursuing this particular purpose? Is there a more significant purpose I should be focused on?
Choose goals and purposes that are consistent with other goals and purposes they have chosen.	Inadvertently negate their own purposes. Do not monitor their thinking for inconsistent goals.	Does one part of my proposal seem to undermine what I am trying to accomplish in another part?
Adjust their thinking regularly to their purpose.	Do not adjust their thinking regularly to their purpose.	Does my argument stick to the issue? Am I acting consistently within my purpose?
Choose purposes that are fair-minded, considering the desires and rights of others equally with their own desires and rights.	Choose purposes that are self-serving at the expense of others' needs and desires.	Is my purpose self-serving or concerned only with my own desires? Does it take into account the rights and needs of other people?

## Questions at Issue or Central Problem

(All reasoning is an attempt to figure something out, to settle some question, solve some problem.)

**Primary Standards:** (1) Clarity and Precision (2) Significance  
(3) Answerability (4) Relevance

**Common Problems:** (1) Unclear and Imprecise (2) Insignificant  
(3) Not answerable (4) Irrelevant

**Principle:** To settle a question, it must be answerable. You must be clear about it and understand what is needed to adequately answer it.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Are clear about the question they are trying to settle.	Are often unclear about the question they are asking.	Am I clear about the main question at issue? Am I able to state it precisely?
Can re-express a question in a variety of ways.	Express questions vaguely and find questions difficult to reformulate for clarity.	Am I able to reformulate my question in several ways to recognize the complexity of it?
Can break a question into sub-questions.	Are unable to break down the questions they are asking.	Have I broken down the main question into sub-questions? What are the sub-questions embedded in the main question?
Routinely distinguish questions of different types.	Confuse questions of different types and, thus, often respond inappropriately to the questions they ask.	Am I confused about the type of question I am asking? For example: Am I confusing a legal question with an ethical one? Am I confusing a question of preference with a question requiring judgment?
Distinguish significant from trivial questions.	Confuse trivial questions with significant ones.	Am I focusing on trivial questions while other significant questions need to be addressed?
Distinguish relevant questions from irrelevant ones.	Confuse irrelevant questions with relevant ones.	Are the questions I am raising in this discussion relevant to the main question at issue?
Are sensitive to the assumptions built into the questions they ask.	Often ask loaded questions.	Is the way I am putting the questions loaded? Am I taking for granted from the onset the correctness of my own position?
Distinguish questions they can answer from questions they can't.	Try to answer questions they are not in a position to answer.	Am I in a position to answer this question? What information would I need to have before I could answer the question?



## Information

(All reasoning is based on data, information, evidence, experience, and research.)

**Primary Standards:** (1) Clear (2) Relevant (3) Fairly gathered and reported  
(4) Accurate (5) Adequate (6) Consistently applied

**Common Problems:** (1) Unclear (2) Irrelevant (3) Biased (4) Inaccurate  
(5) Insufficient (6) Inconsistently applied

**Principle:** Reasoning can be only as sound as the information upon which it is based.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Assert a claim only when they have sufficient evidence to back it up.	Assert claims without considering all relevant information.	Is my assertion supported by evidence?
Can articulate and evaluate the information behind their claims.	Do not articulate the information they are using in their reasoning and so do not subject it to rational scrutiny.	Do I have evidence to support my claim that I have not clearly articulated? Have I evaluated for accuracy and relevance the information I am using?
Actively search for information against (not just for) their position.	Gather information only when it supports their point of view.	Where is a good place to look for evidence on the opposite side? Have I looked there? Have I honestly considered information that does not support my position?
Focus on relevant information and disregard what is irrelevant to the question at issue.	Do not carefully distinguish between relevant information and irrelevant information.	Are my data relevant to the claim I am making? Have I failed to consider relevant information?
Draw conclusions only to the extent that they are supported by the data and sound reasoning.	Make inferences that go beyond what the data supports.	Does my claim go beyond the evidence I have cited?
State their evidence clearly and fairly.	Distort the data or state it inaccurately.	Is my presentation of the pertinent information clear and coherent? Have I distorted information to support my position?



## Inference and Interpretation

(All reasoning contains inferences from which we draw conclusions and give meaning to data and situations.)

**Primary Standards:** (1) Clarity (2) Logicity (3) Justifiability (4) Profundity (5) Reasonability (6) Consistency

**Common Problems:** (1) Unclear (2) Illogical (3) Unjustified (4) Superficial (5) Unreasonable (6) Contradictory

**Principle:** Reasoning can be only as sound as the inferences it makes (or the conclusions to which it comes).

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Are clear about the inferences they are making. Clearly articulate their inferences.	Are often unclear about the inferences they are making. Do not clearly articulate their inferences.	Am I clear about the inferences I am making? Have I clearly articulated my conclusions?
Usually make inferences that follow from the evidence or reasons presented.	Often make inferences that do not follow from the evidence or reasons presented.	Do my conclusions logically follow from the evidence and reasons presented?
Often make inferences that are deep rather than superficial.	Often make inferences that are superficial.	Are my conclusions superficial, given the problem?
Often make inferences or come to conclusions that are reasonable.	Often make inferences or come to conclusions that are unreasonable.	Are my conclusions unreasonable?
Make inferences or come to conclusions that are consistent with each other.	Often make inferences or come to conclusions that are contradictory.	Do the conclusions I reach in the first part of my analysis seem to contradict the conclusions that I come to at the end?
Understand the assumptions that lead to inferences.	Do not seek to figure out the assumptions that lead to inferences.	Is my inference based on a faulty assumption? How would my inference be changed if I were to base it on a different, more justifiable assumption?



## Assumptions

(All reasoning is based on assumptions—beliefs we take for granted.)

**Primary Standards:** (1) Clarity (2) Justifiability (3) Consistency

**Common Problems:** (1) Unclear (2) Unjustified (3) Contradictory

**Principle:** Reasoning can be only as sound as the assumptions on which it is based.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Are clear about the assumptions they are making.	Are often unclear about the assumptions they make.	Are my assumptions clear to me? Do I clearly understand what my assumptions are based on?
Make assumptions that are reasonable and justifiable given the situation and evidence.	Often make unjustified or unreasonable assumptions.	Do I make assumptions about the future based on just one experience from the past? Can I fully justify what I am taking for granted? Are my assumptions justifiable given the evidence I am using to support them?
Make assumptions that are consistent with each other.	Make assumptions that are contradictory.	Do the assumptions I made in the first part of my argument contradict the assumptions I am making now?
Constantly seek to discern and understand their assumptions.	Ignore their assumptions.	What assumptions am I making in this situation? Are they justifiable? Where did I get these assumptions?



## Concepts and Ideas

(All reasoning is expressed through, and shaped by, concepts and ideas.)

**Primary Standards:** (1) Clarity (2) Relevancy (3) Depth (4) Accuracy

**Common Problems:** (1) Unclear (2) Irrelevant (3) Superficial (4) Inaccurate

**Principle:** Reasoning can be only as sound as the assumptions on which it is based.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Recognize the key concepts and ideas they and others use.	Are unaware of the key concepts and ideas they and others use.	What is the main concept I am using in my thinking? What are the main concepts others are using?
Are able to explain the basic implications of the key words and phrases they use.	Cannot accurately explain basic implications of their key words and phrases.	Am I clear about the implications of key concepts? For example: Does the word "argument" have negative implications that the word "rationale" does not?
Distinguish special, nonstandard uses of words from standard uses, and avoid jargon in inappropriate settings.	Do not recognize when their use of a word or phrase or symbol departs from conventional or disciplinary usage.	Where did I get my definitions of this central concept? Is it consistent with convention? Have I put unwarranted conclusions into the definition? Does any of my vocabulary have special connotations that others may not recognize? Have I been careful to define any specialized terms, abbreviations, or mathematical symbols? Have I avoided jargon where possible?
Recognize irrelevant concepts and ideas and use concepts and ideas in ways relevant to their functions.	Use concepts or theories in ways inappropriate to the subject or issue.	Am I using the concept of "efficiency" appropriately? For example: Have I confused "efficiency" and "effectiveness"? Am I applying theories which do not apply to this application?
Think deeply about the concepts they use.	Fail to think deeply about the concepts they use.	Am I thinking deeply enough about this concept? For example: The concept of product safety or durability, as I describe it, does not take into account inexpert customers. Do I need to consider the idea of product safety more deeply?



## Point of View

(All reasoning is done from some point of view.)

**Primary Standards:** (1) Flexibility (2) Fairness (3) Clarity (4) Breadth (5) Relevance

**Common Problems:** (1) Restricted (2) Biased (3) Unclear (4) Narrow (5) Irrelevant

**Principle:** To reason well, you must identify those points of view relevant to the issue and enter these viewpoints empathetically.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Keep in mind that people have different points of view, especially on controversial issues.	Dismiss or disregard alternative reasonable viewpoints.	Have I articulated the point of view from which I am approaching this issue? Have I considered opposing points of view regarding this issue?
Consistently articulate other points of view and reason from within those points of view to adequately understand other points of view.	Cannot see issues from points of view that are significantly different from their own. Cannot reason with empathy from alien points of view.	I may have characterized my own point of view, but have I considered the most significant aspects of the problem from the point of view of others?
Seek other viewpoints, especially when the issue is one they believe in passionately.	Recognize other points of view when the issue is not emotionally charged, but cannot do so for issues about which they feel strongly.	Am I expressing X's point of view in an unfair manner? Am I having difficulty appreciating X's viewpoint because I am emotional about this issue?
Confine their monological reasoning to problems that are clearly monological.*	Confuse multilogical with monological issues; insists that there is only one frame of reference within which a given multilogical question must be decided.	Is the question here monological or multilogical? How can I tell? Am I reasoning as if only one point of view is relevant to this issue when in reality other viewpoints are relevant?
Recognize when they are most likely to be prejudiced.	Are unaware of their own prejudices.	Is this prejudiced or reasoned judgment? If prejudiced, where does it originate?
Approach problems and issues with a richness of vision and an appropriately broad point of view.	Reason from within inappropriately narrow or superficial points of view.	Is my approach to this question too narrow? Am I considering other viewpoints so I can adequately address the problem?

\* Monological problems are ones for which there are definite correct and incorrect answers and definite procedures for getting those answers. In multilogical problems, there are competing schools of thought to be considered.

## Implications and Consequences

(All reasoning leads somewhere. It has implications and, when acted upon, has consequences.)

**Primary Standards:** (1) Significance (2) Logicity (3) Clarity (4) Precision (5) Completeness

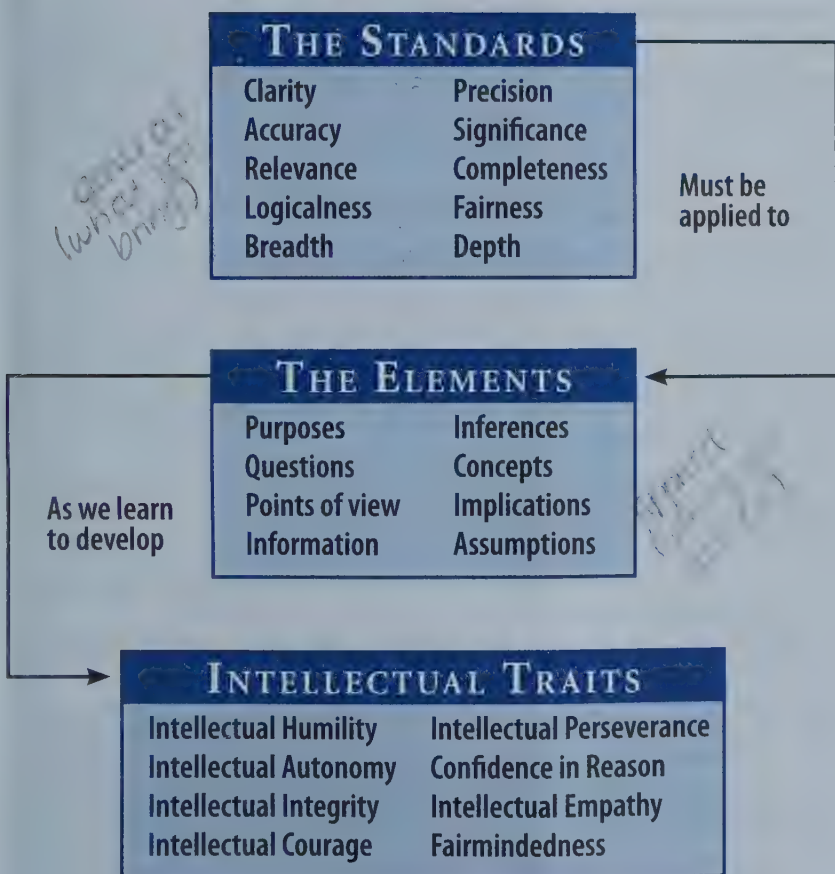
**Common Problems:** (1) Unimportant (2) Unrealistic (3) Unclear (4) Imprecise (5) Incomplete

**Principle:** To reason well through an issue, you might think through the implications that follow from your reasoning. You must think through the consequences likely to flow from the decisions you make.

Skilled Thinkers...	Unskilled Thinkers...	Critical Reflections
Trace out a number of significant potential implications and consequences of their reasoning.	Trace out few or none of the implications and consequences of holding a position or making a decision.	Did I spell out all the significant consequences of the action I am advocating? If I were to take this course of action, what other consequences might follow that I have not considered? Have I considered all plausible failures?
Clearly and precisely articulate the possible implications and consequences.	Are unclear and imprecise in the possible consequences they articulate.	Have I delineated clearly and precisely the consequences likely to follow from my chosen actions?
Search for potentially negative as well as potentially positive consequences.	Trace out <u>only</u> the consequence they had in mind at the beginning, either positive or negative, but usually not both.	I may have done a good job of spelling out some positive implications of the decision I am about to make, but what are some of the possible negative implications or consequences.
Anticipate the likelihood of unexpected negative and positive implications.	Are surprised when their decisions have unexpected consequences.	If I make this decision, what are some possible unexpected implications? What are some of the variables out of my control that might lead to negative consequences?
Considers the reactions of all parties.	Assumes the outcomes and processes will be welcomed by other parties.	What measures are appropriate to help clients understand necessary procedures? Who needs to be involved in the decision?



**Clinicians concerned with good thinking routinely apply *intellectual standards* to the *elements of thought* as they seek to develop the traits of a competent and openminded clinical reasoner.**



## Intellectual Traits Essential to Clinical Reasoning

No clinician can claim perfect objectivity. Our work is unavoidably influenced by strengths and weaknesses in our education, experiences, attitudes, beliefs, and self-interest.

Highly skilled clinicians recognize the importance of cultivating intellectual dispositions. These attributes are essential to excellence of thought. They determine with what insight and integrity one thinks. The clinical process poses distinct questions for the clinician in pursuit of each virtue.

**Intellectual humility** is knowledge of ignorance, being sensitive to what you know and what you do not know. It implies being aware of your biases, prejudices, self-deceptive tendencies, and the limitations of your viewpoint and experience. Clinicians should restrict their professional judgments to those domains in which they are truly qualified. Questions that foster intellectual humility in clinical reasoning thinking include:

- What do I really know about the issue I am facing?
- To what extent do my prejudices, attitudes, or experiences bias my judgment? Does my experience really qualify me to handle this issue?
- Am I quick to admit when I am dealing with an issue beyond my expertise and refer the patient to a specialist?
- Am I open to considering novel approaches to this problem, and willing to learn and study where warranted?

**Intellectual courage** is the disposition to question beliefs about which you feel strongly. It includes questioning the beliefs of your culture and any subculture to which you belong, and a willingness to express your views even when they are unpopular (with administrators, peers, subordinates, or patients). Questions that foster intellectual courage include:

- To what extent have I analyzed the beliefs I hold which may impede my ability to think critically?
- To what extent have I demonstrated a willingness to yield my positions when sufficient evidence is presented against them?
- To what extent am I willing to stand my ground against the majority (even though people might ridicule me)?





**Intellectual empathy** is awareness of the need to actively entertain views that differ from your own, especially those with which you strongly disagree. It entails accurately reconstructing the viewpoints and reasoning of your opponents and reasoning from premises, assumptions, and ideas other than your own. Questions that foster intellectual empathy include:

- To what extent do I listen and seek to understand others' reasoning?
- To what extent do I accurately represent viewpoints with which I disagree?
- To what extent do I accurately represent opponents' views? Would they agree?
- To what extent do I recognize and appreciate insights in the views of others and recognize prejudices in my own?

**Intellectual integrity** consists in holding yourself to the same intellectual standards you expect others to honor (no double standards). Questions that foster intellectual integrity in clinical reasoning include:

- To what extent do I expect of myself what I expect of others?
- To what extent are there contradictions or inconsistencies in the way I deal with clinical issues?
- To what extent do I strive to recognize and eliminate self-deception or self-interest when reasoning through clinical issues?

**Intellectual perseverance** is the disposition to work your way through intellectual complexities despite frustrations inherent in the task. Questions that foster intellectual perseverance in clinical reasoning include:

- Am I willing to work my way through complexities in a clinical issue or do I tend to give up when challenged?
- Can I think of a difficult clinical problem in which I have demonstrated patience and tenacity?
- Do I have strategies for dealing with complex clinical issues?

**Confidence in reason** is based on the belief that one's own higher interests and those of humankind at large are best served by giving the freest play to reason. It means using standards of reasonability as the fundamental criteria by which to judge whether to accept or reject any proposition or position. Questions that foster confidence in reason when thinking clinically include:

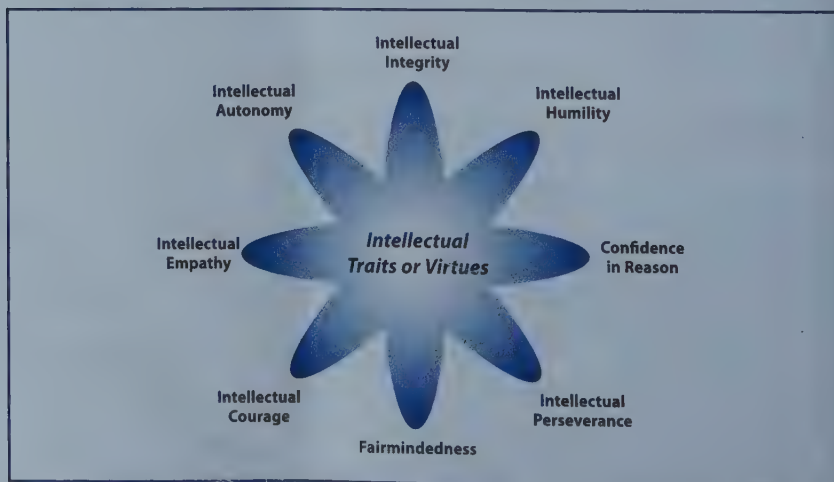
- Am I willing to change my position when the evidence leads to a more reasonable position?
- Do I adhere to sound principles and evidence when persuading others of my position or do I distort matters to support my position?
- Do I encourage others to come to their own clinical conclusions or do I try to coerce agreement?

**Intellectual autonomy** is thinking for oneself while adhering to standards of rationality. It means thinking through issues using one's own thinking rather than uncritically accepting the viewpoints, opinions, and judgments of others. Questions that foster intellectual autonomy in clinical thinking include:

- To what extent do I uncritically accept what I am told (by my supervisors, consultants, peers, patients, and so on)?
- To what extent do I uncritically accept customary, experience-based solutions to problems?
- Do I think through clinical issues on my own or do I merely accept the conclusions or judgments of others?
- Having thought through an issue from a rational perspective, am I willing to stand alone against irrational criticism?

**Fairmindedness** is the state of being conscious of the need to treat all viewpoints alike, without reference to one's own feelings or vested interests, or the feelings or vested interests of one's friends, company, community or nation. It implies adherence to intellectual standards without reference to one's own advantage or the advantage of one's group. Questions that foster fair-mindedness include:

- To what extent do I uncritically accept customary, experience-based solutions to problems?
- To what extent do self-interests or biases tend to cloud my judgment?
- How do I tend to treat relevant viewpoints? Do I tend to favor some over others? And if so, why?
- To what extent do I appropriately weigh the strengths and weaknesses of all significant relevant perspectives when reasoning through an issue?



## The Problem of Egocentric Thinking

Egocentric thinking results from the unfortunate truth that humans do not intrinsically consider the rights and needs of others. We do not naturally appreciate the point of view of others, nor the limitations in our own point of view. Few people become explicitly aware of our egocentric thinking without help from others. We do not intrinsically recognize our egocentric assumptions, the egocentric way we use information, the egocentric way we interpret data, the source of our egocentric concepts and ideas, the implications of our egocentric thought. We do not naturally recognize our self-serving perspective.

As humans we live with the largely unrealistic but confident sense that we have fundamentally figured out the way things actually are, and that we have done this objectively. We naturally believe in our intuitive perceptions—however inaccurate. Instead of using intellectual standards in thinking, we often use self-centered psychological standards to determine what to believe and what to reject. Here are the most commonly used psychological standards in human thinking, along with examples of each from the clinical field.

**“IT’S TRUE BECAUSE I BELIEVE IT.”** Innate egocentrism: I assume that what I believe is true even though I have never questioned the basis for many of my beliefs.

*I am an expert in this particular area of practice and therefore I know better than other clinicians what should be done in this case.*

*Patients with back pain should see a physician and not a chiropractor.*

*Patients should not consult with their pharmacists on alternative treatments for their disease states.*

*The use of computer programs is associated with less misdiagnosis than a careful history and physical exam.*

**“IT’S TRUE BECAUSE WE BELIEVE IT.”** Innate sociocentrism: I assume that the dominant beliefs of the groups to which I belong are true even though I have never questioned the basis for those beliefs.

*We have a great deal of experience in treating our patients with this particular regimen and we know it works. We don’t need to look at other options.*

*Osteopathic physicians are less well trained than allopathic physicians.*

*Doctors should always have the final say over other medical professionals because we are trained better and generally use better judgment.*

**“IT’S TRUE BECAUSE I WANT TO BELIEVE IT.”** Innate wish fulfillment: I believe in whatever puts me (or the groups to which I belong) in a positive light. I believe what “feels good,” what does not require me to change my thinking in any significant way, what does not require me to admit I have been wrong.

## The Problem of Egocentric Thinking (cont.)

*I don't need to concern myself with keeping up with new trends in my specialty because the old ways will always be the best ways.*

*I know that this procedure didn't go wrong because of any faulty of mine.*

*It is best not to tell the patient everything about their condition or the procedures we use, or to let them have too much control over their own care.*

**“IT’S TRUE BECAUSE I HAVE ALWAYS BELIEVED IT.”** Innate self-validation: I have a strong desire to maintain beliefs that I have long held, even though I have not seriously considered the extent to which those beliefs are justified by the evidence.

*I believe X because this is the way I was taught when I was in school and in postgraduate training.*

*I have been doing it this way for a long time and I have never had anyone to question whether or not alternative treatments might be more effective.*

*Tylenol is the best pain medicine because it doesn't cause any serious health problems (compared to other pain medications like aspirin and ibuprofen).*

*Patients with little education are more likely to not take their medicines as prescribed than highly educated patients.*

**“IT’S TRUE BECAUSE IT IS IN MY SELFISH INTEREST TO BELIEVE IT.”** Innate selfishness: I believe whatever justifies my getting more power, money, or personal advantage even though these beliefs are not grounded in sound reasoning or evidence.

*I am going to order this procedure because I know the insurance company will pay for it and I need to pay for this equipment (which is used in this procedure).*

*Alternative approaches to medicine have no place in the treatment of patients.*

*Drug X is a good drug; therefore I am willing to say that I have written this article for publication in a medical journal supporting its use, even though the article was in fact written by the drug company that is paying me to put my name on the article.*

Clinicians, like all humans, are apt to think egocentrically at least some of the time. The extent to which they do is a matter of degree. And when they do, there are important implications for the quality of patient care.

Each of us must determine, in any given situation, whether and to what extent we are operating from irrational thinking and behavior. The closer we examine our behavior, the more likely we are to find irrationality at work. But because the human mind is naturally self-deception, this can be challenging and takes a life-long commitment to living an examined life.

## The Problem of Sociocentric Thinking

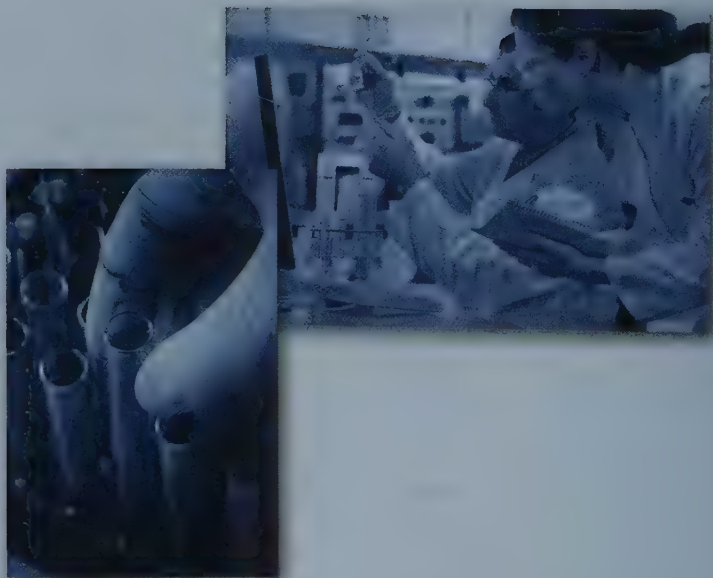
Most people do not understand the degree to which they have uncritically internalized the dominant prejudices of their society or culture. Sociologists and anthropologists identify this as the state of being “culture bound.” This phenomenon is caused by sociocentric thinking, which includes:

- The uncritical tendency to place one’s culture, nation, religion above all others.
- The uncritical tendency to select self-serving positive descriptions of ourselves and negative descriptions of those who think differently from us.
- The uncritical tendency to internalize group norms and beliefs, take on group identities, and act as we are expected to act—without the least sense that what we are doing might reasonably be questioned.
- The tendency to blindly conform to group restrictions (many of which are arbitrary or coercive).
- The failure to think beyond the traditional prejudices of one’s culture.
- The failure to study and internalize the insights of other cultures (improving thereby the breadth and depth of one’s thinking).
- The failure to distinguish universal ethics from relativistic cultural requirements and taboos.
- The failure to realize that mass media in every culture shapes the news from the point of view of that culture.
- The failure to think historically and anthropologically (and hence to be trapped in current ways of thinking).
- The failure to see sociocentric thinking as a significant impediment to intellectual development.

Sociocentric thinking is a hallmark of an uncritical society. It can be diminished only when replaced by cross-cultural, fairminded thinking — critical thinking in the strong sense.

Every social group, including the professions, is subject to these sociocentric tendencies. Clinical practice is not unique in this regard. This truth can be exemplified in any number of ways. Take, for example, the unhealthy climate that

sometimes exists in clinical settings when doctors see themselves as superior to other health personnel and thus have a kind of “in-group, out-group” mentality toward other professional groups in the clinical setting. This phenomenon has numerous implications for how nurses, technicians, and other professionals experience the clinical environment, as well as for the quality of care clients receive. Or consider the traditional view that “doctors know best” and patients’ views are therefore secondary to doctor’s views. Or consider the fact that clients (or family members of clients) are sometimes treated better by clinicians because of their social or professional status. All of these cases, and numerous others like then, exemplify sociocentricity or “group think” with important clinical implications.



## Mistakes in Thinking and Vested Interest Often Lead to the Violation of Intellectual Standards

People who think and work within any discipline sometimes violate intellectual standards. One reason for this, we suggest, is a lack of explicit awareness of intellectual standards and their importance to thinking well. Another, we propose, is vested interest (when 'professionals' have a personal interest in violating one or more intellectual standards).

Within the field of medicine, for example, the importance of *gathering relevant information and accurately diagnosing patients* is presupposed. Yet, an individual doctor may misdiagnose a patient by failing to consider some important relevant information or by making some other mistake in thinking. In his book, *How Doctors Think* (2007), Jerome Groopman, M.D. links the problem of medical misdiagnosis to what he terms 'cognitive errors':

Misdiagnosis...is a window into the medical mind. It reveals why doctors fail to question their assumptions, why their thinking is sometimes closed or skewed, why they overlook the gaps in their knowledge. Experts studying misguided care have recently concluded that the majority of errors are due to flaws in physician thinking, not technical mistakes. In one study of misdiagnoses, that caused serious harm to patients, some 80 percent could be accounted for by a cascade of cognitive errors...putting [clients] into a narrow frame and ignoring information that contradicted a fixed notion. Another study of one hundred incorrect diagnoses found that inadequate medical knowledge was the reason for error in only four instances. The doctors didn't stumble because of their ignorance of clinical facts; rather they misdiagnosed because they fell into cognitive traps. Such errors produce a distressingly high rate of misdiagnosis. As many as 15 percent of all diagnoses are inaccurate...(p. 24).

Consider, as well, the number of people injured each year due to receiving incorrect dosages or types of medicine, a significant issue linked to problems in reasoning:

"At least 1.5 million Americans a year are injured after receiving the wrong medication or the incorrect dose, according to the Institute of Medicine, part of the National Academies of Science. Such incidents have more than doubled in the past decade. The errors are made when pharmacists stock the drugs improperly, nurses don't double-check to make sure they are dispensing the proper medication or when doctors'

illegible handwriting results in the wrong drug being dispensed, among other causes (*Press Democrat*, November 23, 2007)."

Such problems as these, which can occur in any profession, may well result from simple mistakes in thinking. But they may also result from a more complex root problem.

For example, a doctor may be tacitly *motivated* to diagnose a patient with a particular condition because the doctor specializes in that condition. He therefore may seek only that information *which happens to lead* to a diagnosis within his specialty. He may do this because it serves his interest (landing him additional patients, and therefore, more money) or, more likely, simply because he interprets the information through the lens of his own specialty. When vested interest is the culprit, we suggest that it is coupled with self-deception. The doctor would need to actually believe in his diagnosis, and systematically fail to notice his narrow-mindedness. For example, he might deceive himself into believing that he has gathered all the significant *relevant* information (when he has not), that there is only one *reasonable* diagnosis (when there is more than one), that he is unbiased in his orientation to the problem (when, in fact, he is prejudiced).

Indeed, wherever the pursuit of vested interest is likely, we might expect possible violations of intellectual standards in reasoning. Consider the following example of a potential conflict of interest seen in child psychiatry with important implications for the increasing number of children being diagnosed with "bipolar disorder." The phenomenon exemplified here is that of researchers being paid by medical companies that develop products to 'solve' the problems researchers 'uncover.' It is unfortunately part of the much larger issue of vested interest potentially influencing medical decision-making (thereby causing errors in human judgment):

A world-renowned Harvard child psychologist whose work has helped fuel an explosion in the use of powerful antipsychotic medicines in children earned at least \$1.6 million in consulting fees from drug makers from 2000-2007 but for years did not report much of this income to university officials, according to information given to Congressional investigators...Dr. Biederman is one of the most influential researchers in child psychiatry...Although many of his studies are small and often financed by drug makers, his work helped to fuel a controversial 40-fold increase from 1994 to 2003 in the diagnosis of pediatric bipolar disorder, which [has led to] a rapid rise in the use of antipsychotic medicines in children...it is far from clear that the medications improve children's lives, experts say...In the last 25 years, drug and device makers have



displaced the federal government as the primary sources of research financing, and industry support is vital to many university research programs. But as corporate research executives recruit the brightest scientists, their brethren in marketing departments have discovered that some of these same scientists can be terrific pitchmen... Many researchers strongly disagree over what bipolar looks like in youngsters, and some now fear the definition has been expanded unnecessarily, due in part to the Harvard group... Dr. E. Fuller Torrey, executive director of the Stanley Medical Research Institute, which finances psychiatric studies, [contends] "In the area of child psychiatry in particular, we know much less than we should, and we desperately need research that is not influenced by industry money (*The New York Times*, June 8, 2008)."

If it is in a researcher's financial interest to find that a behavioral problem exists for which medicine can be prescribed, a medicine developed by the company funding the research, it is only reasonable to question whether and to what extent such studies can be said to be *unbiased*.

Or consider an example in the field of agriculture. For decades, the primary form of vegetable farming has been large crop farming with mass use of chemical pesticides. In the meantime, scientists have become increasingly aware of the myriad problems caused by overuse of pesticides. Two of the most significant of these problems include ecological destruction and human disease escalation (caused by pesticide exposure through ingestion and inhalation). For many years, eminent scientists world-wide have spoken out against these destructive practices. And yet the problem largely remains. By continuing to overuse pesticides, the agricultural community sanctions reasoning, tacitly or explicitly, that violates intellectual standards. By ignoring relevant and significant information, by failing to think through logical implications, by covering up or ignoring important evidence, agriculturalists violate some of the very ideals they advance. It seems reasonable to link this failure to the problem of vested interest - the simple fact that farming with pesticides is cheaper than farming without them.

## Ethics and Clinical Reasoning<sup>1</sup>

Clinical reasoning is a systematic way to reach a decision about the best course of action to take for a given patient. If done properly, it *clearly* and *accurately* defines the clinical question that needs to be answered, evaluates all *relevant data* and *significant information* obtained from the history, physical, and appropriate laboratory and diagnostic studies, acquires and critically appraises *pertinent* evidence from reference books, primary literature, and past experiences, identifies and assesses assumptions being made about the patient, the problem, and the proposed solution, and includes a thoughtful review of the implications and consequences of the clinical decision.

In addition to being reasonable, clinical decisions also need to be ethical. All the steps outlined above focus on the clinician's perspective. But, to engage in ethical reasoning the clinician needs to take into account the patient's perspective. To what extent has the patient participated in the decision? What has been done to explore the patient's own health care beliefs? Are there any ethical issues that need to be addressed?

There are certain principles that can be applied to clinical decision making that will help guide the clinician in ethical reasoning. The first of these weighs the risks and benefits of the action that would be taken if the decision is carried out. Clinicians are quite familiar with the famous dictum "First, do no harm," and that clearly gets at the risks side of the equation. But, there is also the question, "How will the patient benefit?" For example, if there is little possibility that the patient will benefit from a proposed treatment then the risks of the treatment may outweigh the benefit, and such treatment could be considered unethical. A recent example of this comes from the practice of vertebroplasty to treat painful vertebral fractures caused by osteoporosis. Vertebroplasty is done by injecting formulated bone cement into the vertebrae to stabilize spinal fractures. It is a minimally invasive procedure performed in an outpatient setting at \$2,000 to \$5000 per injection. In two separate randomized controlled trials published in the *New England Journal of Medicine*, there was no difference in outcome between vertebroplasty and a sham procedure (*New England Journal of Medicine* 2009; 361:557-579). To continue this practice in spite of compelling evidence that it provides no benefit beyond a placebo effect is not ethical.

Another principle brings into consideration patient rights. Patients have the right to participate in clinical decisions involving their health. It is the clinician's responsibility to understand and respect the patient's perspective, health care beliefs, ethical values, and personal preferences. The exclusion of patient rights in clinical decision-making is not only unethical but it also may bring about physical, psychological, social, or financial harm. This, of course, is in violation of the first principle.

A third principle stems from a societal perspective. Sometimes clinical decisions are made in the context of what actions should be taken for the greater good – for the good of society as a whole rather than for the good of an individual patient. Organ

<sup>1</sup> For a deeper understanding of ethical reasoning, see *The Thinker's Guide to Understanding the Foundations of Ethical Reasoning* by Richard Paul and Linda Elder, 2006, Dillon Beach, CA: Foundation for Critical Thinking Press.

transplantation sometimes evokes an ethical problem. Who should get the heart transplant, a 15-year-old child with aspirations of becoming a teacher or a 65 year old adult who has lived a productive life as a doctor? When the supply of influenza vaccine is limited and a widespread epidemic is expected, who gets the flu vaccine, young healthy children and pregnant women or elderly patients with chronic diseases? The approach to these ethical dilemmas are sometimes handled by professional guidelines. Ethical clinical reasoning requires strict adherence to these guidelines for the benefit of society over individual cases.

The last principle is fairness. All patients should be treated with the same respect, compassion, empathy, and importance regardless of race, ethnicity, gender, social status, level of education, or insurance coverage. To do anything less under any circumstance is unethical. A prerequisite to clinical ethical reasoning is treating each patient equally. All patients should have equal access to medical care, although unfortunately this is not the case given the state of current health care coverage in the U.S.

One impediment to ethical reasoning in clinical practice is the fact that ethics is often confused with other modes of thinking such as social ideology, conventions, rules and mores, religious belief systems, and the law. For example, in the U.S. from the late 19th century to the mid 20th century, homosexuals were treated by medical professionals as deviants in need of medical care. This led to the criminalization of homosexuality (since homosexuals were considered a danger to society). Because clinicians, like everyone, are indoctrinated into the social ideologies of the culture in which they are raised, and because clinicians don't necessarily learn to critically assess these ideologies, they may well inappropriately use them in making clinical decisions.

Another significant impediment to reasoning ethically in clinical practice, as discussed above, is the fact that people are largely egocentric and thus see the world from a narrow self-interested view. Everyone falls prey to this intrinsic human phenomenon. This problem can and does impact the quality of clinical reasoning in any number of ways. Consider, for example, the fact that doctors are more likely to order medical tests when they perform such tests at their offices than when they don't; psychiatrists and psychologists can sometimes be "bought" as witnesses for either side in criminal cases; clinicians are sometimes paid by pharmaceutical companies to write articles for medical journals, and so on.

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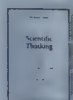
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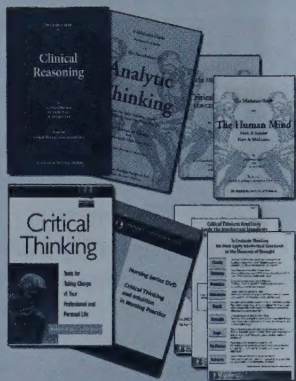


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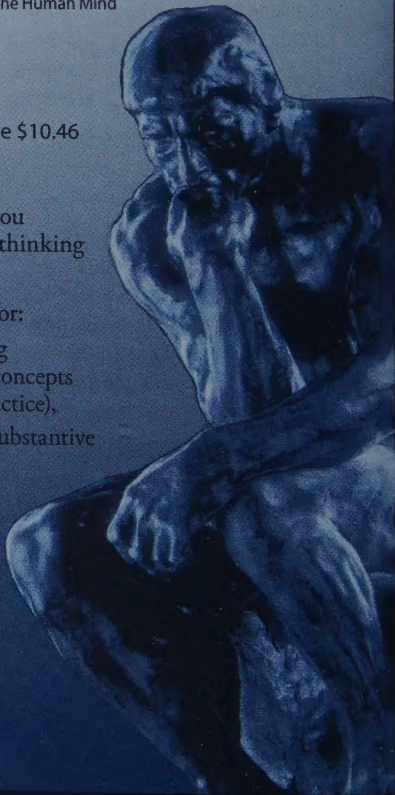
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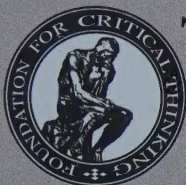
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P.O. Box 220  
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The Foundation for Critical Thinking  
PO Box 220  
Dillon Beach, CA 94929

## About the Authors

**Dr. David Hawkins** is Professor and Dean at California Northstate College of Pharmacy. He received his B.S. degree in Pharmacy from the University of Georgia and his Doctor of Pharmacy degree from the University of Michigan. He also completed a postgraduate residency in clinical pharmacy at the University of Michigan Medical Center in Ann Arbor. Dr. Hawkins' academic career includes previous faculty appointments in pharmacy at the University of Texas, University of Georgia, Mercer University, and South University and in medicine at the University of Texas Health Science Center at San Antonio, East Carolina University, and the Medical College of Georgia. He has more than 100 publications in the medical and pharmacy literature and has a passion for engaging students in critical thinking and team-based learning.



**Dr. Linda Elder** is an educational psychologist who has taught both psychology and critical thinking at the college level. She is the President of the Foundation for Critical Thinking and the Executive Director of the Center for Critical Thinking. Dr. Elder has a special interest in the relation of thought and emotion, the cognitive and the affective, and has developed an original theory of the stages of critical thinking development. She has coauthored several books on critical thinking, as well as twenty-one thinkers' guides.



**Dr. Richard Paul** is a major leader in the international critical thinking movement. He is Director of Research at the Center for Critical Thinking, and the Chair of the National Council on Excellence in Critical Thinking, author of over 200 articles and seven books on critical thinking. Dr. Paul has given hundreds of workshops on critical thinking and produced a series of eight critical thinking video programs for PBS. His views on critical thinking have been canvassed in *New York Times*, *Education Week*, *The Chronicle of Higher Education*, *American Teacher*, *Educational Leadership*, *Newsweek*, *U.S. News and World Report*, and *Reader's Digest*.



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