



# *Methods of Incorporating Critical Thinking into the Curriculum*

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# Critical Thinking in Respiratory Care

- What is it?
- Why is it important?
- Can you measure it?
- Can you teach it?
- Methods
  - Problem and case based learning
  - Simulations
    - High fidelity
    - Standardized patients
  - Flipping the classroom
  - Student evaluation
- Critical diagnostic thinking
  - Identify the problem
  - Patient history and physical
  - Formulation and evaluation of hypothesis
  - Laboratory evaluation
  - Assessment of the effect of therapy
  - Pitfalls and common mistakes
- Summary and conclusions

*Methods of Incorporating Critical Thinking into the Curriculum*

**WHAT IS CRITICAL  
THINKING?**

# What is critical thinking?

*“Critical thinking merges the principles of logical reasoning, problem solving, judgment, decision making , reflection and life-long learning”.*

Mishoe S. Critical thinking in respiratory care. In: Mishoe SC, Welch MA. New York: McGraw-Hill, 2002, p. 33-64.

# What is clinical problem solving?

*“The recognition that a problem exists, followed by a systematic process during which a solution, or often solutions, to the problem are then determined, implemented and evaluated”*

Welch MA. Clinical problem solving. In: Mishoe SC, Welch MA (eds.) Critical thinking in respiratory care. McGraw-Hill: New York, 2002.

# Critical Thinking and Problem Solving

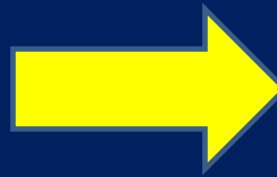
Critical Thinking

Clinical Reasoning

Diagnostic Reasoning

Decision Analysis

Problem Solving



Clinical

Decision

Making

# Characteristics of Critical Thinkers

## Critical Thinkers

Clear

Precise

Specific

Analytical

Logical

Reflective

Thorough

Consistent

Accurate

Valid

## Uncritical Thinkers

Confused

Unrefined

Vague

Shallow

Illogical

Unreflective

Superficial

Inconsistent

Inaccurate

Invalid

# Cognitive Domains

Evaluation

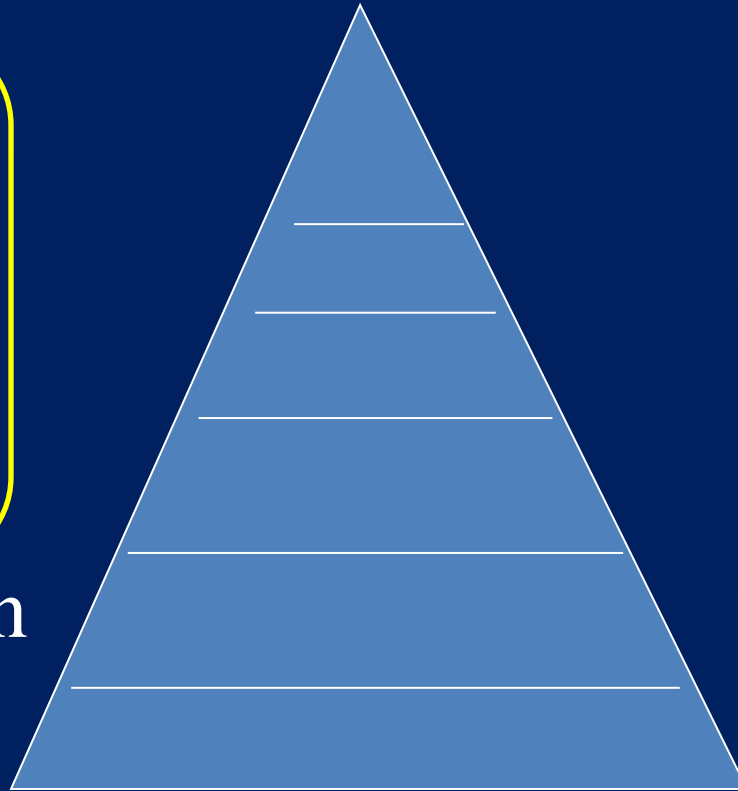
Synthesis

Analysis

Application

Comprehension

Recall



Critical Thinking



# Learning Domains

- **Cognitive**

- Knowledge
- Comprehension
- Application
- Synthesis
- Analysis
- Evaluation

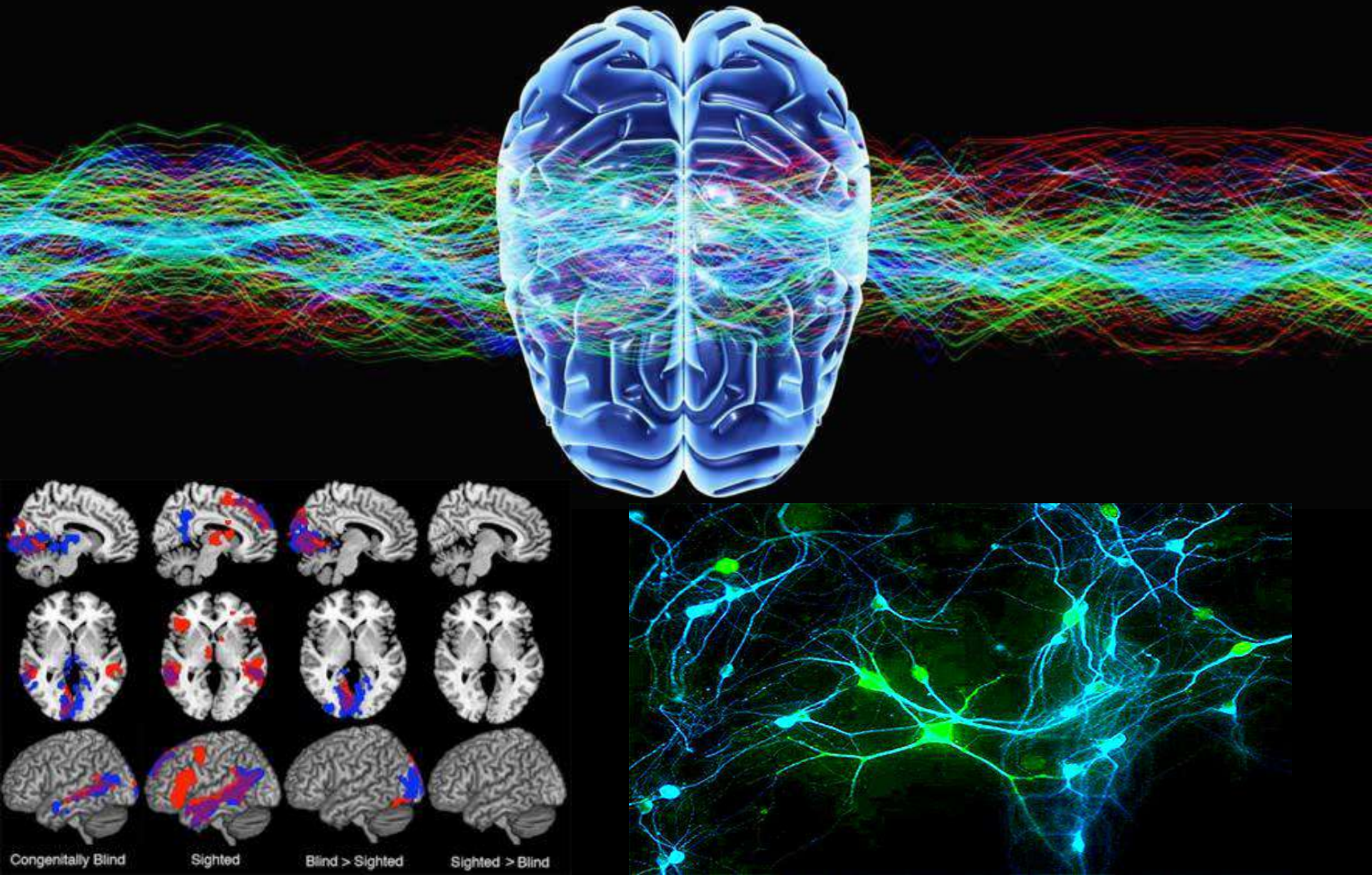
- **Affective**

- Receiving – paying attention
- Responding – participating in learning
- Valuing – assigning value to something
- Organizing – organizing values, information, ideas
- Characterizing – value or belief influences, behavior – become, intrinsic

- **Psychomotor**

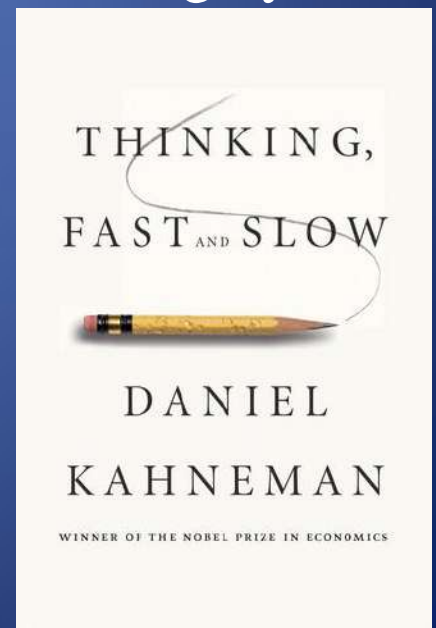
- Perception – uses sensory cues to guide motor activity
- Set – ready to act
- Guided response – early stages of learning skill
- Mechanism – action becomes habit – perform with confidence and proficiency
- Complex overt response – perform without hesitation, quick, accurate, coordinated
- Adaptation – modify actions to meet special requirements
- Origination – create new movement patterns for new situations

# Thinking about thinking

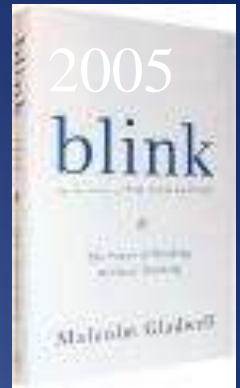


# Fast and Slow Thinking

- *Thinking, Fast and Slow*, Kahneman D, 2011
- Psychologist, Nobel prize in economics in 2002
  - Prospect theory of decision making
    - irrationality and cognitive biases
- Two modes of thought:
  - **System 1:** Fast, automatic, frequent, intuitive and largely unconscious mode; emotional, stereotypic, uses association and metaphor
  - **System 2:** Slow, effortful, infrequent, logical, calculating, conscious, reasoned choices



# Blink



- Rapid cognition, in a “blink of an eye”
  - Your mind takes about two seconds to jump to a series of conclusions
    - I like (or dislike) this person, place or thing
    - This patient is not breathing right
- ED doctors at Cook County Hospital in Chicago and heart attacks
  - Instructed to gather *less* information on their patients
  - Encouraged to zero in on a few critical pieces of information re: chest pain while ignoring everything else
  - Improved at diagnosing chest pain
- 10,000 hour rule for success in an activity - *Outliers*



# Neuroscience of Learning

- One of the most important ideas in contemporary neuroscience is plasticity—the brain's ability to physically remodel itself in response to experience or learning.
- Learning is essentially a process of neurological change; as we absorb new skills and information, neurons form new connections and prune back others, and the brain as a whole recalibrates its networks and activity patterns.
- The science of how the brain perceives information, responds to data, and develops skills has major potential to transform the practice of education.

# Should teachers learn neuroscience?

- Paul A. Howard-Jones (British neuroscientist) says that “a neuromythology has arisen in schools” because teachers know so little about the brain.
- A common error is that “different brains have different learning styles, when the fact is that most brains operate pretty much the same.”
- An error made even by “very bright people, is the old saw that we only use a small percentage of our brains. Not true.”
- “The idea that the two hemispheres of the brain may learn differently has virtually no grounding in neuroscience research.”
- Every cognitive skill that has been investigated using neuroimaging to date employs a network of brain regions spread across both cerebral hemispheres, including language and reading, and thus no evidence exists for any type of learning that is specific to one side of the brain.

*Moreno, JD. Should Teachers Learn Neuroscience? The Brain Boom in the Classroom, Psychology Today, 6/2012 and Educational Neuroscience, Wikipedia, 2012*

# Key Elements of Critical Thinking

## **Interpreting**

Categorizing

Decoding significance

Clarifying meaning

## **Evaluating**

Assessing claims

Assessing arguments

## **Explaining**

Stating results

Justifying procedures

Presenting arguments

## **Analyzing**

Examining ideas

Identifying arguments

Analyzing arguments

## **Inferring**

Querying evidence

Conjecturing alternatives

## **Self-Regulating**

Self-examining

Self-correcting

# Critical Thinking in the Health Professions

The cognitive critical thinking skills can be understood as follows:

- 1. Interpretation:** accurately interpreting problems as well as objective and subjective data from common information sources, related to the care of the patient;
- 2. Analysis:** examining ideas/arguments in problems, objective and subjective data and possible courses of action related to the care of the patient;
- 3. Inference:** querying claims, assessing arguments (recognizes faulty reasoning) and reaching conclusions that are appropriate to the care of the patient;
- 4. Explanation:** to clearly explain and defend the reasoning in which an individual arrives at specific decisions in the context of the health care of the patient;
- 5. Evaluation:** to evaluate information to ascertain its probable trustworthiness as well as its relevance to particular patient care situations; and
- 6. Self-regulation:** constantly monitoring one's own thinking using universal criteria, for example, clarity, precision, accuracy, consistency, logic, significance, and so on, and correcting oneself as appropriate in the context of caring for patients.

Elaine Simpson E, Courtney M. *Critical thinking in nursing education: literature review International Journal of Nursing Practice* 2002; 8: 89–98



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**WHY IS CRITICAL THINKING  
NEEDED?**

# Need for Critical Thinking and Problem Solving in Respiratory Care

- Patient problems
  - Assessment and evaluation
  - Diagnosis and treatment
  - Problem solving
- Technology problems
  - Select
  - Apply
  - Evaluate
  - Troubleshoot
- People Problems
  - Physicians
  - Nurses
  - Co-workers
  - Others

# Situations That Require Critical Thinking

## *Patients*

- Patient assessment
- Care plan development
- Management of acute and chronic disease
- Unexpected response to care
- Problems with patient management:
  - Patient fighting the ventilator
  - Patient not adequately oxygenated and/or ventilated
- Modification in respiratory care
- Responding to patient questions and reactions
- Mistakes or problems with patient care
- Multiple patient problems or situations demanding the therapist's time simultaneously
- Rare diseases or situations
- Emergencies:
  - Cardiac arrest
  - Respiratory failure
  - Inadvertent extubation
  - Emergency intubation
- Patient transports and admissions
- Novel Approaches to respiratory care
- Neonatal delivery and transports
- Patients assessment
- Coaching, reassuring, and instructing patients

# Situations That Require Critical Thinking

## *Technology*

- Equipment malfunction
- Shortage of equipment
- Selecting and gathering equipment and supplies
- Equipment not easily located
- Evaluating, using, and troubleshooting new technology
- Alarms activated
- Recommend technology or therapy
- Modifying equipment for novel care
- Equipment not set-up or available when needed in an emergency

# Situations That Require Critical Thinking

## *Other Clinicians*

- Questions from nurses, physicians, clinicians
- Medical order does not coincide with patient care or with proposed care plan
- Making suggestions and recommendations
- Conflicting requests/demands from other clinicians
- Unclear or inappropriate medical order
- Another clinician's behavior threatens the patient
- Multiple persons talking to or asking for the respiratory therapist at the same time
- Asking questions
- Share in decision making with other clinicians

## Competencies Needed by Graduate Respiratory Therapists in 2015 and Beyond

- ***“Graduate therapists need to begin RT practice with excellent critical thinking skills,*** to deal with complex technology and protocols.”
- ***“Problem solving skills are needed*** to calibrate, operate, and troubleshoot complex technology, such as microprocessor-driven, multimode mechanical ventilators and other sophisticated life-support equipment.”
- ***“Patient management decisions must be made*** when using RT protocols such as evidence-based ventilator weaning.”
- “When a patient fails a weaning trial, ***critical thinking decisions must include a search for other causes or complicating factors*** such as adequacy of pain control, appropriateness of sedation, fluid status, bronchodilator need, and control of myocardial ischemia and other disease processes that can affect discontinuation attempts.”

## Competencies Needed by Graduate Respiratory Therapists in 2015 and Beyond

- Therapists must “fully understand the tenets of *evidence-based medicine*, including the ability to *critically read and critique the medical literature* and discuss the meaning of statistical analysis.
  - Interaction with the ICU patient care team requires an in-depth working knowledge of evidence-based medicine.
  - The large number of randomized controlled trials in respiratory critical care requires the graduate to have the ability to critically review the literature and to critique the statistical methodology used to evaluate study results.<sup>13</sup>
- *Critical thinking and communication skills to discuss their position on the care of patients* during rounds and to advocate for the best approach to respiratory care for the specific patient are essential.

# Competencies Needed by Graduate Respiratory Therapists in 2015 and Beyond

- RTs in 2015 must assume greater responsibility *for acute and chronic disease management* in order to reduce the cost of healthcare.
- The necessary *critical thinking skills can be broken down into 3 domains: technology, patients, and clinicians* .
- *Further delineation of critical thinking skills* needed by RTs has been *identified by Mishoe*, in 7 key areas: prioritizing, anticipating, troubleshooting, communicating, negotiating, decision making, and reflecting
- *A high level of critical thinking skills and the ability to apply the appropriate best-practice protocols* was identified by both AARC conferences as a requisite for treatment of critically ill patients in ICUs and emergency departments.



# AARC 2015 Competencies

Table 2. Competency Area I: Diagnostics\*

Descriptor	Definition
A. Pulmonary Function Technology	<ol style="list-style-type: none"> <li>1. Perform basic spirometry, including adequate coaching, recognition of improperly performed maneuvers, corrective actions, and interpretation of test results.</li> <li>2. Compare and evaluate indications and contraindications for advanced pulmonary function tests (plethysmography, diffusion capacity, esophageal pressure, metabolic testing, and diaphragm stimulation) and be able to recognize normal/abnormal results.</li> </ol>
B. Sleep	<ol style="list-style-type: none"> <li>1. Compare and evaluate the indications and contraindications for sleep studies.</li> <li>2. Understand results in relation to types of respiratory sleep disorders.</li> </ol>

## C. Invasive Diagnostic Procedures

1. Explain the indications and contraindications, and general hazards and complications of bronchoscopy.
2. Describe the bronchoscopy procedure and describe the respiratory therapist's role in assisting the physician.
3. Monitor and evaluate the patient's clinical condition with pulse oximetry, electrocardiogram, exhaled gas analysis, and other related diagnostic devices.
4. Perform arterial puncture and sampling and blood analysis.

# AARC 2015 Competencies

## Table 3. Competency Area II: Disease Management\*

### A. Chronic Disease Management

1. Understand the etiology, anatomy, pathophysiology, diagnosis, and treatment of cardiopulmonary diseases and comorbidities.
2. Communicate and educate to empower and engage patients.
- 3. Develop, administer, and re-evaluate the care plan**

### B. Acute Disease Management

- 1. Develop, administer, evaluate, and modify respiratory care plans in the acute-care setting**, using evidence based medicine, protocols, and clinical practice guidelines.
2. Incorporate the patient/therapist participation principles listed in chronic disease management (see IIA.).

# AARC 2015 Competencies

## **Table 4. Competency Area III: Evidence-Based Medicine and RC Protocols**

### Evidence-Based Medicine

1. Review and critique published research.
2. Explain the meaning of general statistical tests.
3. Apply evidence-based medicine to clinical practice.

### B. Respiratory Care Protocols

1. Explain the use of evidence-based medicine in the development and application of hospital-based respiratory care protocols.
2. **Evaluate and treat patients in a variety of settings**, using the appropriate respiratory care protocols.

## **Table 5. Competency Area IV: Patient Assessment**

1. Patient assessment (chart review, interview, history)
2. Diagnostic data
3. Physical examination

## **Table 6. Competency Area V: Leadership** team member, healthcare regulatory systems, communications, healthcare finance, team

# AARC 2015 Competencies

## Survey of Directors of Respiratory Therapy Departments Regarding the Future Education and Credentialing of Respiratory Care Students and Staff

- Responses by directors on 66 competencies the 2015 report:
  - 90% agreement on 37
  - 50%-90% agreement on 25
  - < 50% agreement on 4 (ECMO, sleep, research/statistics)
- Education preparation: 36.8% BS or MS; 36.7% AD, 26.5%) no preference.
- 41.8% indicated that a BSRT or MSRT should be required to qualify for a license to deliver respiratory care.
- 81.2% in favor of the RRT being required to practice

*Evidence supports the need by 2015 and beyond for graduate RTs to master 66 competencies in 7 major areas.*

**AARC BOD accepted the competencies needed by future RTs as recommended. July 2012**

## Adult Critical Care Specialty Examination



### Development of the New Adult Critical Care Specialty Examination is Now Underway!

The NBRC is excited to announce the upcoming launch of a new specialty examination for respiratory therapists working in adult critical care settings. We sought input from a variety of organizations representing professionals involved in the arena of adult critical care so we could create a valuable credential that your employer, colleagues and patients will recognize and respect.

#### Links

[Self-Assessment Examination](#)[Submit an Online Application](#)[General FAQs](#)[Free Practice Examination](#)[Assessment Centers](#)

- Examination *launched Tuesday, July 17, 2012.*
- Applicants are now able to sit for the examination.
- Applicants who schedule to test before 9/1/2012 will receive the ACCS Self-Assessment Examination for free (a \$40 value)!
- Candidates can visit the ACCS page for more information on this new examination

## Adult Critical Care Specialty Examination Matrix

### Content Area

### Cognitive Level

#### Analysis

#### Application

#### Recall

#### Number of Items

Recall	Application	Analysis	Number of Items
5	18	35	58
1	3	6	10
0	2	2	4
4	12	24	40
0	1	3	4
7	27	58	92
0	5	22	27
1	3	6	10
1	2	4	7
1	3	7	11
1	2	1	4
2	2	3	7
0	3	4	7
0	1	3	4
1	1	1	3
0	1	2	3
0	1	1	2
0	3	4	7
12	45	93	150

### Totals

### I. RESPIRATORY CRITICAL CARE

- A. Manage Airways
- B. Administer Specialty Gases
- C. Manage Ventilation
- D. Deliver Pharmacologic Agents

### II. GENERAL CRITICAL CARE

- A. Assess Patient Status and Changes in Status
- B. Anticipate Care Based on Laboratory Results
- C. Anticipate Care Based on Imaging and Reports of Imaging
- D. Anticipate Effects of Pharmacologic Agents
- E. Anticipate Care Based on Nutritional Status
- F. Prevent Ventilator Associated Pneumonia
- G. Recognize and Manage Patients with Infections and Sepsis
- H. Manage End-of-Life Care
- I. Prepare for Disasters
- J. Interact with Members of an Interdisciplinary Team
- K. Perform Procedures
- L. Troubleshoot Systems



# Critical Thinking in Respiratory Care

1. Mishoe S. Critical thinking, educational preparation, and development of respiratory care practitioners. *Distinguished Papers Monograph* 1993; 2:29-43
2. Mishoe SC. Critical thinking in respiratory care practice: A qualitative study. *Respiratory Care* 2003; 48(5):500-516.
3. Goodfellow LT, Valentine T, Holt M. Construction and validation of an instrument to assess critical thinking in respiratory care: An empirical process. *Respiratory Care Education Annual* 1999; 8(1):13-25.
4. Goodfellow LT. Respiratory therapists and critical-thinking behaviors: A self assessment. *Journal of Allied Health* 2001; 30(1):20-25.
5. Shelledy DC, Stoller JK. An introduction to critical diagnostic thinking. In: Stoller JK, Bakow ED, Longworth DL, eds. *Critical diagnostic thinking in respiratory care*. Philadelphia: W.B. Saunders Co.; 2002, p. 3-38.
6. Mishoe S. Critical thinking in respiratory care. In: Mishoe SC, Welch MA. New York: McGraw-Hill, 2002, p. 33-64.
7. Welch MA. Clinical problem solving. In: Mishoe SC, Welch MA, eds. *Critical thinking in respiratory care*. New York: McGraw-Hill; 2002, p. 65-84.

# Critical thinking in respiratory care practice

- Mishoe (1995) focused on the expert practice of 18 respiratory therapists employed in acute care settings.
- To Mishoe, critical thinking in the practice of respiratory therapy is the cognitive process described by **logical reasoning, problem solving, and reflection**.
- This working definition incorporates the reflective, communicative, practical, and experiential aspects of critical thinking.
- Mishoe determined that critical thinking in respiratory care practice involves the abilities to *prioritize, anticipate, troubleshoot, communicate, negotiate, reflect, and make decisions*.

Mishoe, S. C. (1995). Critical thinking in respiratory care practice. *Dissertation Abstracts International*, 55(10), 3066A. (University Microfilms No. 9507227)



# Critical thinking skills needed by respiratory therapists

The critical thinking skills thought to be needed by respiratory therapists include the ability to

- Prioritize
- Anticipate
- Troubleshoot
- Communicate
- Make decisions
- Negotiate and reflect.

# Essential Critical Thinking Skills

- **Prioritizing:** “Rapid think” and “Organized think”
  - The expected
  - The unexpected
- **Anticipating:** “Future think”
  - Problems
  - Solutions
- **Troubleshooting:** “Technical Think”
  - Technology
  - Systems
- **Communicating:** “People think”
  - Practitioner-specific
  - Situation-specific
- **Negotiating:** “Shared think”
  - Responsibilities
  - Medical orders for patient care
- **Decision Making:** “Personal think”
  - Individual
  - Joint
  - Consultative
- **Reflecting:** “Inward think” and “Past think”
  - The patients
  - The decisions
  - The profession

# Past Experience



## Individual Competence

### Prioritizing

- Expected → "organized think"
- Unexpected → "rapid think"

### Anticipating

- Expected/Unexpected → "future think"

### Troubleshooting

- Expected/Unexpected → "technical think"



## Decision Making

"personal think"



## Shared Competence

- Communicating  
"people think"
- Negotiating  
"shared think"



## Reflecting

"Past think"  
"Inward think"



# New Situation

## Prioritize

- Anticipate
- Troubleshoot
- Communicate
- Make decisions
- Negotiate and reflect

*Methods of Incorporating Critical Thinking into the Curriculum*

**HOW IS CRITICAL THINKING  
MEASURED?**

# Measurement of Critical Thinking

- Watson-Glaser and similar instruments
- Written examinations
  - WRRT
  - Teacher made tests
- Clinical simulation exams
- Self ratings of critical thinking skills
- Observational ratings of critical thinking skills

# Watson-Glaser Critical Thinking Appraisal (WGCT)

- Evaluates subjects' ability to make inferences, recognize assumptions, perform deduction, and interpret and evaluate arguments
- The WGCT uses five subtests:
  1. Ability to make inferences
  2. Recognize assumptions
  3. Perform deduction
  4. Interpret arguments
  5. Evaluate arguments
- Subtest scores combined to generate an overall critical thinking score.

Berger A. Review of the Watson-Glaser Critical Thinking Appraisal. In: Mitchel JV, editor. The ninth mental measurements yearbook. Lincoln: The University of Nebraska Press; 1985, p. 1691-1694.

# CCTST and CCTDI

- California Critical Thinking Skills Test (CCTST)
  - Five subscales (analysis, deduction, induction, evaluation, and inference.)
- California Critical Thinking Disposition Inventory (CCTDI) →affective dimensions of critical thinking, or one's propensity toward thinking critically.
  - Seven subscales (truth seeking, open mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity.)
- Content validity derived from definition of critical thinking developed by the American Philosophical Association and the California State University system.

# Clinical Simulation Exams

*“The Clinical Simulation Exam (CSE) from the National Board for Respiratory Care (NBRC) is considered by experts in philosophy and social sciences to be one of the few domain-specific instruments for assessment of critical thinking (Facione, 1990; Mishoe, Dennison, & Goodfellow, 1997)”*

- *NBRC CSE's*
  - *widely thought to provide a measure of respiratory therapists critical thinking and problem solving abilities.*
  - *result in an information gathering (IG) and decision making (DM) score based on a series of clinical problems which the examinee must complete.*
  - *reported to have demonstrated content validity, criterion-related validity, and reliability.*



# Effects of Content, Process, Computer-Assisted Instruction, and Critical-Thinking Ability on Students' Performance on Written Clinical Simulations

We compared the effects of content instruction (CI), process instruction (PI), computer-assisted instruction (CAI), and critical-thinking ability on student performance on a written latent-image clinical simulation problem (CSP).

- **CAI and CI were associated with significant improvements in students' decision-making (DM) scores.**
- PI was associated with significant improvements in students' information-gathering (IG) scores.
- It appears that understanding the exam process improves student IG performance, while content knowledge and CAI improve DM.
- There was **a moderate correlation between critical-thinking ability and performance on IG.**
- **General critical thinking** was not related to initial DM performance, but may have **had an impact on students' ability to gain from instruction and practice.**

Shelledy DC, Valley MA, Murphy DL, Carpenter ME Respiratory Care Education Annual, 6, 1997, 11-29

# PREDICTING GRADUATE PERFORMANCE ON SELECTED RESPIRATORY CARE PROGRAM OUTCOME MEASURES: DEVELOPMENT OF A CORRELATIONAL MODEL

- Significant relationship between CRT scores and WGCT ( $r = .43$ ,  $r^2 = .19$   $p < .05$ )

LeGrand TS, Shelledy DC, Respiratory Care Education Annual,  
8, 1999, 3-11

# Is There a Relationship Between Student Performance on the Written Self-Assessment Examination, and Tests of Critical Thinking Skills or Critical Thinking Dispositions?

The CCTDI, CCTST, and each of the individual subscores are not valid predictors of student performance on the WRT.

**Johnson JC, Van Scoder LI, *Respiratory Care Education Annual*, 11, 2002, 32-33**

# The Relationship Between General Critical Thinking Ability and Student Performance

- WGCTA correlated with student performance as assessed by GPA, CRTSAE and performance on the IG portion of a CSP.
- There was no relationship between WGCTA and CSP DM.
- General critical thinking ability may be useful in predicting student performance in a respiratory care program.

*Shelledy DC, Gardner DD, Carpenter ME, Murphy DL  
Respiratory Care Education Annual, 13, 2004,23-28*

## A comparison of respiratory therapy students' critical thinking abilities with performance on the clinical simulation examinations

- There was a significant correlation ( $r=0.34$ ) between WGCTA (59 7.2) and DM scores (66 15).
- They also found that GPA (3.40 .43) was significantly related to WGCTA ( $r=0.45$ ) and DM ( $r=0.43$ ).

Mishoe, S. C., Dennison, F. H., & Goodfellow, L. T. (1997). *Respiratory Care*, 42, 1078

Critical thinking ability in respiratory care students and its correlations with age, educational background and performance on the national board examinations

No relationship between WGCTA and CSE exam performance

Wettstein RB, Wilkins RL, Gardner DD, Restrepo RD. *Resp Care* 2011; 56(3): 284-289

# Summary

- General critical thinking ability correlates with:
  - CSE IG (Shelledy, 1997)
  - CSE DM improvement (Shelledy et al, 1997)
  - CSE DM ( Mishoe et al., 1997)
  - CRT (Shelledy et al., 1999)
- General critical thinking ability does not correlate with:
  - WRT (Johnson and VanScoder, 2002)
  - CSE DM (Shelledy et al., 2004)
  - CSE (Wettstein et al., 2011)

# CONSTRUCTION AND VALIDATION OF AN INSTRUMENT TO ASSESS CRITICAL THINKING IN RESPIRATORY CARE

*.....rate yourself in response to each of the following questions.*

1. How well do you decide which procedures can wait?
2. How well do you prioritize in crisis situations?
3. How well do you revise your priorities when interruptions occur?
4. How well do you adjust your priorities when you have difficulty accessing your patients?
5. How well do you juggle emergencies?
6. How well do you set priorities in routine care?
7. How well do you manage your time?
8. How well do you anticipate emergencies?
9. How well do you anticipate equipment failures?
10. How well do you predict changes in patient conditions before they happen?
11. How well do you willingly participate in training or education to anticipate changes in technology or patient care?
12. How well do you mentally rehearse a procedure in your mind before you perform the procedure on a patient?
13. How well do you use your troubleshooting skills when working without assistance in your work setting?

*1-Not well; 2-Fairly well; 3-Somewhat well; 4-Quite well; 5-Very well; 6-Extremely well*



14. How well do you use your troubleshooting skills when working with physicians?
15. How well do you use your troubleshooting skills when working with nurses?
16. How well do you troubleshoot chest tubes?
17. How well do you troubleshoot blood gas analyzers?
18. How well do you evaluate more than just the machine when you are troubleshooting?
19. How well do you communicate with nurses when planning patient care?
20. How well do you communicate with physicians when planning patient care?
21. How well do you communicate with other RC practitioners when planning patient care?
22. How well do you communicate with patients when planning patient care?
23. How well do you communicate with patient's family members when planning patient care?
24. How well do you communicate by writing in the patient medical record?
25. How well do you negotiate with physicians to make changes in the treatment plan for your patients?
26. How well do you negotiate with other members of the health care team regarding patient care plans?
27. How well do you listen to competing viewpoints when negotiating patient care?
28. How well do you challenge erroneous or unclear orders from a physician?
29. How well do you inform or teach physicians about procedures or techniques when negotiating changes in patient care?

## Development of an Instrument for the Assessment of Students' Critical Thinking and Problem Solving Ability

- CTPS scores were compared to the Watson-Glaser Critical Thinking Appraisal (WGCT) and the IG and DM total scores on four NBRC self-assessment clinical simulation problems.
- Interrater reliability for the CTPS was  $r=0.66$  ( $n=20$ ;  $p=0.002$ )
- Cronbach's alpha was .95 and .99 for the two faculty raters, respectively.
- There were significant correlations between CTPS scores and WGCT ( $r=0.54$ ;  $p=0.02$ ), IG ( $r=0.51$ ;  $p=0.03$ ), and DM ( $r=0.47$ ;  $p=0.04$ ).
- There were also significant correlations between WGCT and IG ( $r=0.49$ ;  $p=0.04$ ) and DM ( $r=0.74$ ;  $p=0.0003$ ).
- Findings provide evidence supporting the reliability and validity of the CTPS instrument.
- Faculty ratings of CTPS correlated significantly with general critical thinking ability and the combined scores for IG and DM on the NBRC clinical simulation problems.

## Development of an Instrument for the Assessment of Students' Critical Thinking and Problem Solving Ability

***Directions:** Please assess the following individual's critical thinking and problem solving abilities by carefully reading each of the listed statements. After reading each statement, check the one answer which best reflects how much you agree or disagree with the statement as it applies specifically to this individual:*

Agree Very Much = 7; Agree Pretty Much = 6; Agree a Little = 5; Disagree a Little = 3; Disagree Pretty Much = 2 ;Disagree Very Much = 1

1. Recognizes clinical situations requiring action.
2. Gathers appropriate clinical information.
3. Interprets clinical data correctly.
4. Applies principles and concepts to clinical decision making.
5. Analyzes clinical data accurately.
6. Explains the rationale for clinical decisions.
7. Understands concepts related to the patients condition.
8. Evaluates treatment alternatives.
9. Is able to generalize and apply problem solving skills to new and different situations.
10. Has strong patient assessment skills.
11. Categorizes clinical information that it can be used effectively.
12. Clarifies misunderstandings and areas of ambiguity by gathering additional data.

Agree Very Much = 7; Agree Pretty Much = 6; Agree a Little = 5;  
Disagree a Little = 3; Disagree Pretty Much = 2 ;Disagree Very Much = 1

## Development of an Instrument for the Assessment of Students' Critical Thinking and Problem Solving Ability

13. Identifies alternate solutions to problems.
14. Draws appropriate conclusions from available data.
15. Explains the rationale for choosing specific solutions to a problem.
16. Corrects/modifies thinking based on new information.
17. Critically examines personal concepts and ideas.
18. Has a creative approach to problem solving.
19. Has excellent critical thinking skills.
20. Is good at solving problems.
21. Makes appropriate clinical decisions.

# Teacher- Made Tests and Evaluations

- Multiple choice tests
  - Write higher level learning objective
    - Application
    - Analysis
    - Synthesis
    - Evaluation
  - Make a test matrix in advance
    - Specify the number of items by content area AND level
    - For example: 5 items on assessment of oxygenation status
      - 1 comprehension
      - 1 application
      - 1 analysis
      - 1 synthesis
      - 1 evaluation

# Teacher- Made Tests and Evaluations

Content	Recall (Knowledge/ Comprehension)	Application	Analysis (Synthesis/ Evaluation)
Assessment of Oxygenation	5	5	5
Assessment of Ventilation	5	5	5
Assessment of Acid-Base Balance	5	5	5
Assessment of Circulation	5	5	5
TOTAL	20	20	20
GRAND TOTAL=60			



# Teacher- Made Tests and Evaluations

- Clinical simulation laboratory practical exams
  - Scenario provided
  - Student must setup and adjust mechanical ventilatory support
- Writing assignments with grading rubrics
- Projects
  - Design
  - Implement
  - Evaluate

# Teacher- Made Test and Evaluations

- Perform a complete assessment of you patient and then develop a detailed respiratory care plan to include the rational for each of your recommendations, as well as your planned follow-up evaluation to determine the effectiveness of the care provided.
  - Patient assessment
    - Chart review, history, physical
  - Respiratory care plan
    - Plan
    - Rationale (to include indications, contraindications and hazards )
    - Planned followup and evaluation

Volume 15, Summer 2006,  
21-30

# Respiratory Care Education Annual

*The American Association  
for Respiratory Care*

Volume 15

Sum

## ***Original Contributions***

A Comparison of Certified Respiratory Therapists (CRT) and Registered Respiratory Therapists (RRT) on Selected Demographic and Job Variables

*David C. Shelledy, PhD, RRT, RPFT, FAARC and  
Donna D. Gardner, MSHP, RRT* .....

A Survey of Gerontology/Geriatric Curricular Components Being Associate And Baccalaureate Degree Respiratory Care Programs

*Helen M. Sorenson, MA, RRT, CPFT, FAARC;  
David C. Shelledy, PhD, RRT, RPFT, FAARC; Alisa D. Jones, BS  
and Mando Morales, BS, RRT* .....

Authentic Assessment of Learning Outcomes

*Lynda A. Britton, PhD, CLS(NCA) and  
Dennis Wissing, PhD, RRT, AE-C* .....

Identifying the Variables of Grading Practices That Influence Student Evaluation of Clinical Instructors

*Arzu Ari, PhD, CRT, CPFT; Douglas S. Gardenhire, MS, RRT-NF*

*.....the use of scoring rubrics  
and how these rubrics can be  
used to assess and grade  
student performance*

## **Authentic Assessment of Learning Outcomes**

**Lynda A. Britton, PhD, CLS(NCA)**

**Dennis Wissing, PhD, RRT, AE-C**

### **Abstract**

Traditional testing and measurement using paper and pencil examinations has been shown to be limited in determining what students really understand about a concept or procedure. Alternative assessment strategies have recently been shown to be effective in determining what the student knows while providing a degree of knowledge building during the assessment process. One example of these new strategies is authentic assessment (AA). Authentic assessment evaluates student performance with assignments, projects, procedures, and other activities that require skills that closely mimic those that will be needed in the workplace upon completion of an educational program. Using AA can assist the student to develop desirable traits such as critical thinking, problem solving, and life-long learning. Employing various types of rubrics in the classroom and laboratory may provide the teacher with a more valid and reliable measurement of student understanding. This paper will provide a brief overview of the use of holistic and analytic scoring rubrics in the respiratory care classroom.

**Key Words:** authentic assessment, professional, educational measurement, holistic evaluation, performance based assessment, rating scales, scoring rubrics.

Table 3  
*Presentation of a Case Study Rubric*

<b>Oral Presentation of Case Study</b> Dr. Britton Student: _____				
CATEGORY	<b>Outstanding 10 points</b>	<b>Very Good 8-9 points</b>	<b>Good 7-8 points</b>	<b>Fair &lt;7 points</b>
<b>Outline/ Handout</b>	PowerPoint handout or other complete outline and references; follows presentation completely	PowerPoint handout or other complete outline and references; follows oral presentation 90% of the time	PowerPoint handout or other complete outline and references; follows oral presentation 80% of the time	PowerPoint handout or other complete outline; lacks references; follows oral presentation <80% of the time
<b>Visual Aids</b>	Illustrates the points of presentation with 8 or more diagrams, tables, charts, or illustrations; follows guidelines; appropriate to content	Illustrates the points of presentation with 5-7 diagrams, tables, charts, or illustrations; follows guidelines; most are appropriate to content	Illustrates the points of presentation with 2-4 diagrams, tables, charts, or illustrations; follows some of the guidelines; some are inappropriate to content	Illustrates the points of presentation with 1-0 diagrams, tables, charts, or illustrations; do not follow guidelines; or inappropriate to content
<b>References</b>	8 total; 5 from refereed journals, none older than 5 years, fewer than 3 approved websites	6 or 7 total; 4 from refereed journals; none older than 5 years; fewer than 3 approved websites	3-5 total; 3 from refereed journals; none older than 7 years; <5 approved websites—1-2 unapproved websites	<2 refereed journals, none older than 10 years; >5 websites or unapproved websites used



Table 3 Continued  
Presentation of a Case Study Rubric

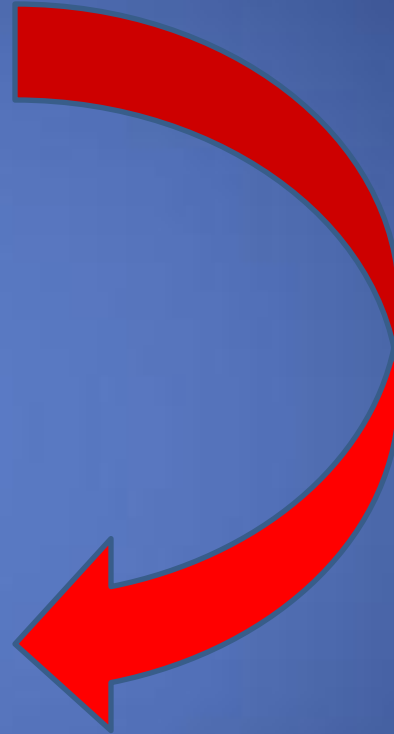
CATEGORY	Outstanding 10 points	Very Good 8-9 points	Good 7-8 points	Fair <7 points
<b>Content</b>	Demonstrates full understanding of the topic.	Demonstrates good understanding of the topic.	Demonstrates some understanding of parts of the topic.	Does not seem to understand the topic very well.
<b>Organization</b>	Excellent flow and transition from topic to topic; persuasive	Good flow and transition from one topic to another; somewhat persuasive	Some flow and transition from topic to topic; not cohesive	Little transition and poor organization
<b>Timing</b>	Topic addressed completely within time limits	Topic addressed completely with +/- 2 minutes	Topic addressed incompletely in time limits; within +/- 5 minutes	Topic incompletely addressed in time limits and/or < 5 minutes
<b>Posture and Eye Contact</b>	Stands up straight, looks relaxed and confident; establishes eye contact with everyone in the room during the presentation.	Stands up straight and establishes eye contact with everyone in the room during the presentation, not very relaxed or confident	Sometimes stands up straight and establishes eye contact but not confident and relaxed	Slouches and/or does not look at people during the presentation; indifferent or very nervous
<b>Vocabulary</b>	Uses vocabulary appropriate for the audience; extends audience vocabulary by defining words and terms that might be new to most.	Uses vocabulary appropriate for the audience; includes 1-2 words or terms that might be new to most of the audience, but does not define them.	Uses vocabulary inappropriate for the audience; does not explain 3 or 4 words or terms that might be new to the audience.	Uses several (5 or more) words or phrases that are not understood by the audience; vocabulary is inappropriate, for example, slang is used.
<b>Volume</b>	Volume is loud enough to be heard by all audience members throughout the presentation.	Volume is loud enough to be heard by all audience members at least 90% of the time.	Volume is loud enough to be heard by all audience members at least 80% of the time.	Volume often too soft or mumbled to be heard by all audience members.
<b>Inappropriate habits</b>	Does not use fillers such as "uh, um, you know"	Uses fillers such as "uh, um, you know" 3 times or fewer times	Uses fillers such as "uh, um, you know" 5 times or fewer times	Uses fillers such as "uh, um, you know" 6 or more times

*Methods of Incorporating Critical Thinking into the Curriculum*

**HOW CAN WE TEACH  
CRITICAL THINKING?**

# Teaching Critical Thinking

- Methods
  - Problem-based learning
  - Team-based learning
  - Case-based learning
  - Simulations
    - High fidelity
    - Standardized patients
  - Flipping the classroom
  - Audience response systems
- Student evaluation
  - Multiple choice testing
  - Rubrics
  - Simulations
  - Projects (case presentations, capstone projects)





# Learning Theory

- Behaviorism
  - Modeling
  - Shaping
  - Chaining
  - Rewards for desired outcomes
  - Negative reinforcements use is rare
  - No punishment (unless patient safety at issue)
- Principles of learning:
  - Active vs. passive
  - Repetition important
  - Reward correct response
  - Motivation is important
  - Group work
  - Minimize conflict
  - Anxiety affects learning
  - Make structure clear
  - Know the learner
  - Organization of content
  - Learning with understanding
  - Differential abilities

# The Learning Pyramid

We tend to comprehend...

10% of what we **READ**

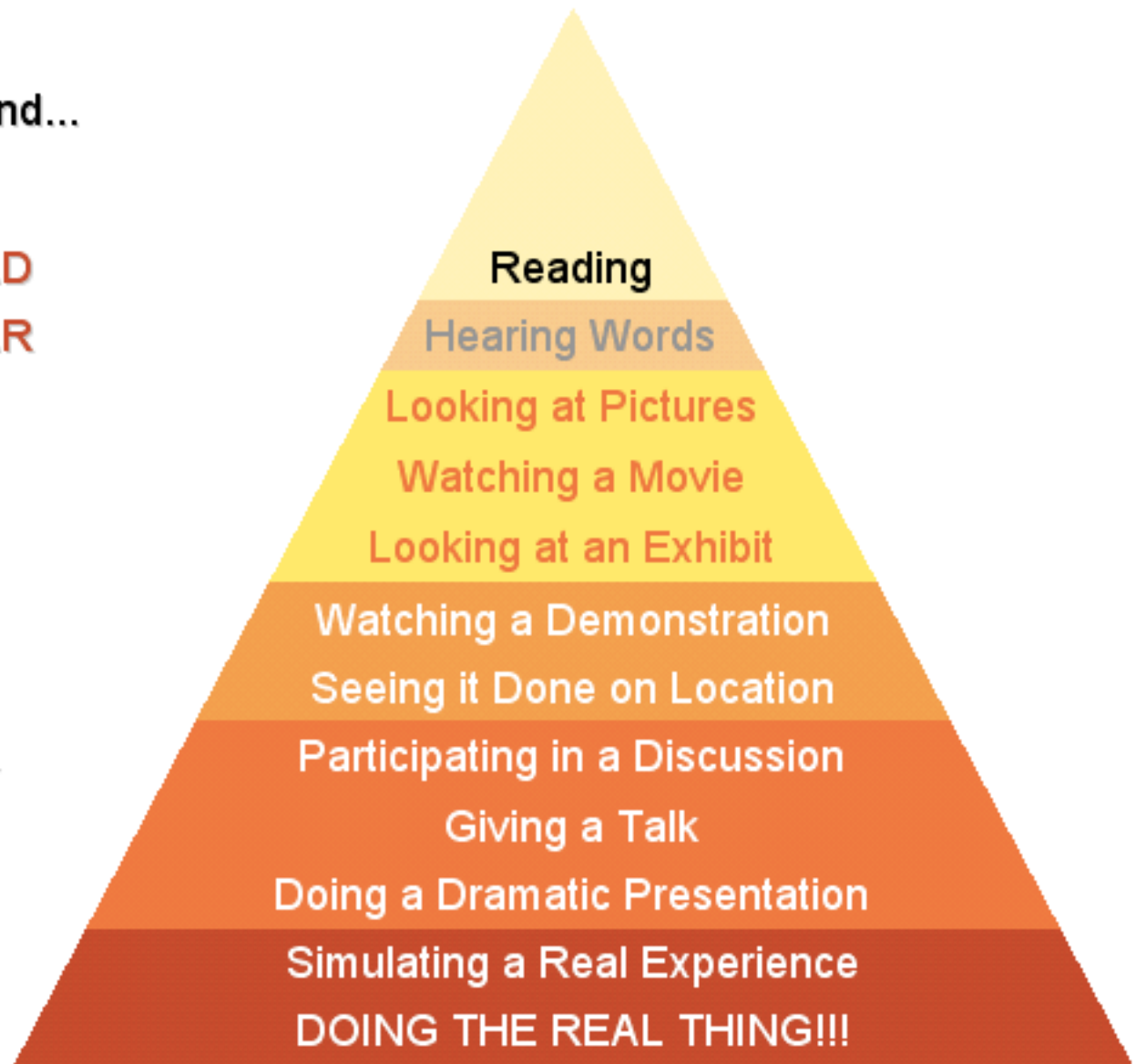
20% of what we **HEAR**

30% of what we **SEE**

50% of what we both  
**HEAR and SEE**

70% of what we **SAY**

90% of what we both  
**SAY and DO**



# Problem-based learning

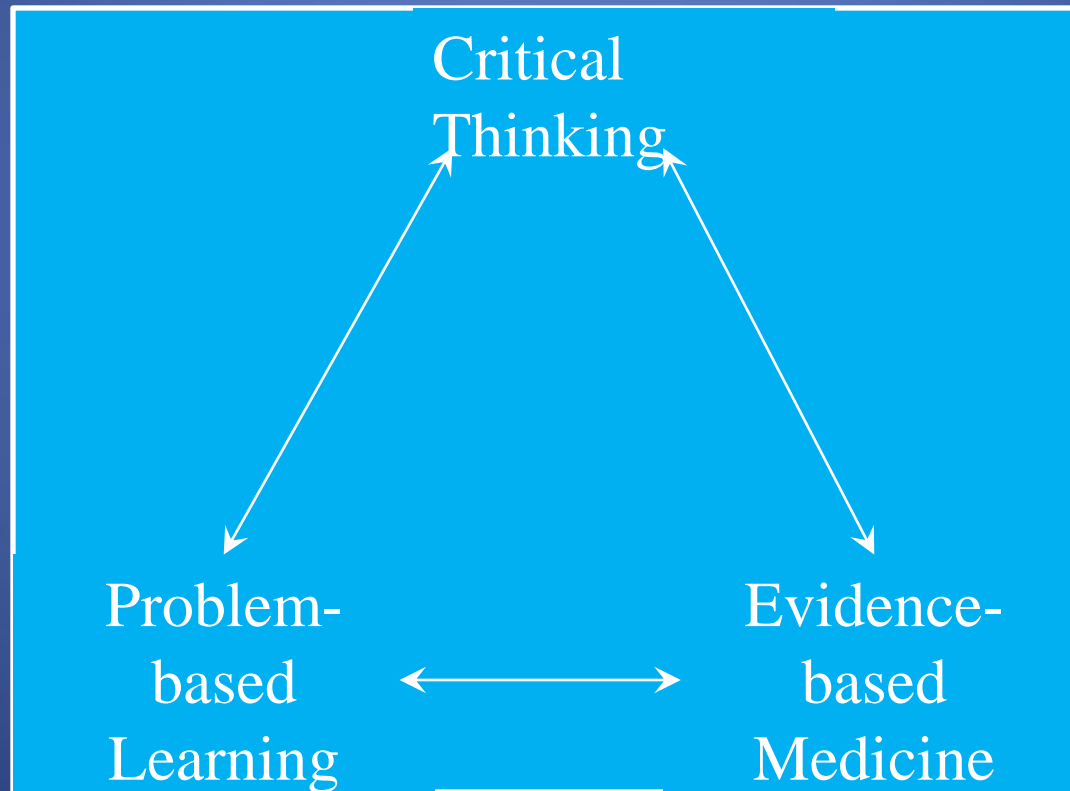
# Problem-based Learning (PBL)

- “.....introduced into the curricula of a number of nursing and medical education schools as a method of promoting the development of critical-thinking skills ..... and clinical problem-solving skills”
- Evaluations of PBL have generally been positive with:
  - higher levels of critical-thinking skills
  - autonomous learning and
  - problem-solving and decision making skills
  - communication skills,
  - reflection and motivation for continued learning.

Elaine Simpson E, Courtney M. *Critical thinking in nursing education: literature review International Journal of Nursing Practice* 2002; 8: 89–98

# Problem-Based Learning (PBL)

*“A teaching-learning strategy where by students direct their learning by working in small groups to solve problems like the ones they will encounter in the real world in their professional practice”*



Mishoe SC. Introduction to problem-based learning. In: Mishoe SC, Welch MA (eds.) Critical thinking in respiratory care: a problem-based learning approach. McGraw-Hill: New York, 2002.

# Comparison of PBL with Traditional Teaching

## PBL

- Student-directed
- Active learning
- Centered on patient cases
- Emphasis on cognitive skills
- Curriculum organized around problems
- Retrieval and use of medical information
- Centers on group discussion, communication skills, and problem solving
- Addresses biological, clinical, and psychosocial issues

## Lecture

- Teacher-directed
- Passive listening
- Centered on lecture notes
- Emphasis on knowledge acquisition
- Curriculum organized around disciplines
- Relies on textbooks and notes
- Centers on listening, independent reading, testing to assess knowledge
- Primarily focuses on treatment of pathophysiology

# Problem-based & case-based learning in RC education

- .....to produce a graduate with improved critical thinking and life-long learning skills.
- .....to help the graduate pass the NBRC CSE.
- use of cases .....which students research and discuss.
- The heart of the PBL is the tutorial group, composed of a group 5-7 students and a faculty facilitator.
  - Students work through the case, listing facts, testing hypotheses, learning pharmacology, and studying the learning issues of the case.
  - Information learned in the context of the patient case, rather than in isolated classes.
  - Cases are presented in the progressive-disclosure model.
- Student evaluation consists of written examinations, self- and peer evaluation, and case study process.
- Students like PBL, think that they are performing better than their non-PBL and CSE pass rates are above the national average.



# Problem Solving Model

Problem solving models are often based on a simple step-wise model.

1. Identify (recognize) problems
2. Collect information (patient/ situational assessment)
3. Interpret data
  - analyze information
  - categorize/organize data
  - relate general concepts to specific situations
  - recognize conflicting data
  - gather additional information
  - draw conclusions
4. Formulate solutions
  - critically examine concepts and ideas
  - identify alternatives
  - choose/explain specific solutions
  - identify creative solutions
5. Solve problems/make decisions
6. Re-evaluate based on patient response/new information

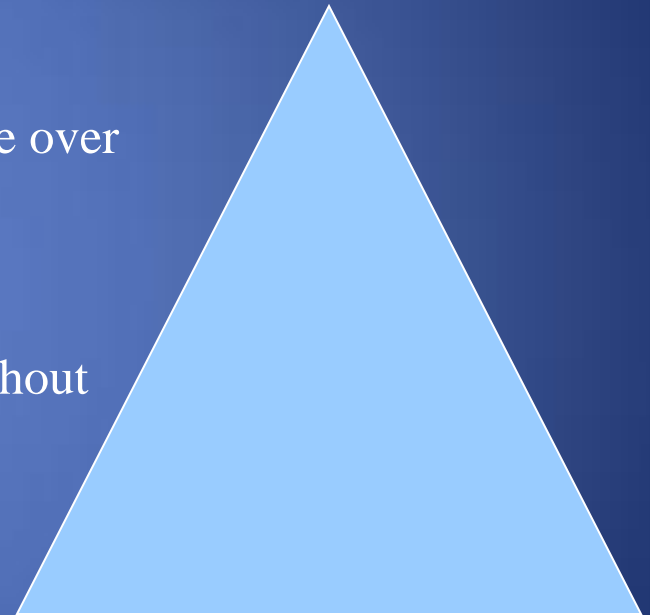
# Evidence Based Decision Making

- Etiology
- Prognosis
- Diagnostic testing
  - Accurate
  - Reliable
  - Appropriate
- Treatment
- Prevention

# Best Evidence

- RCTs; Meta-analysis of RCTs and Multicenter RCTs
  - Best evidence for therapy
- Cohort studies
  - Follow a large group with a treatment or disease over time
  - Etiology or harm
- Case-control studies
  - Compares patients with the disease to those without it
- Case series/case reports
  - Collection of cases or a single patient
- Opinions/letters
- Animal research
- In-vitro research

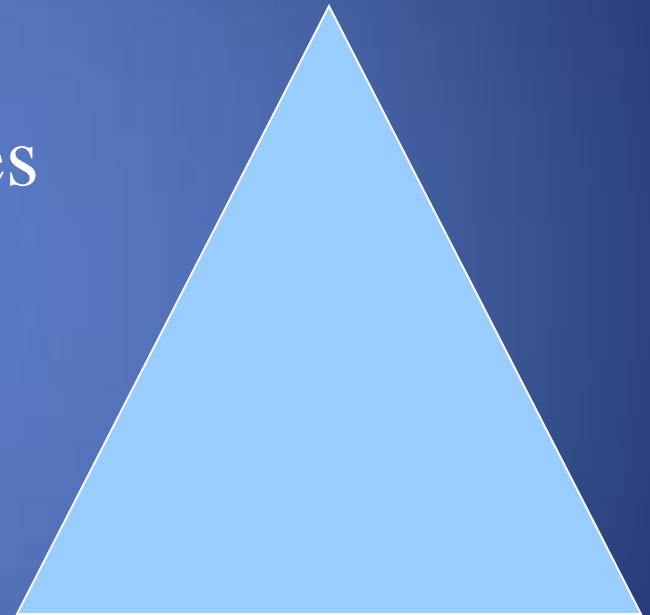
Best Evidence



# Best Evidence

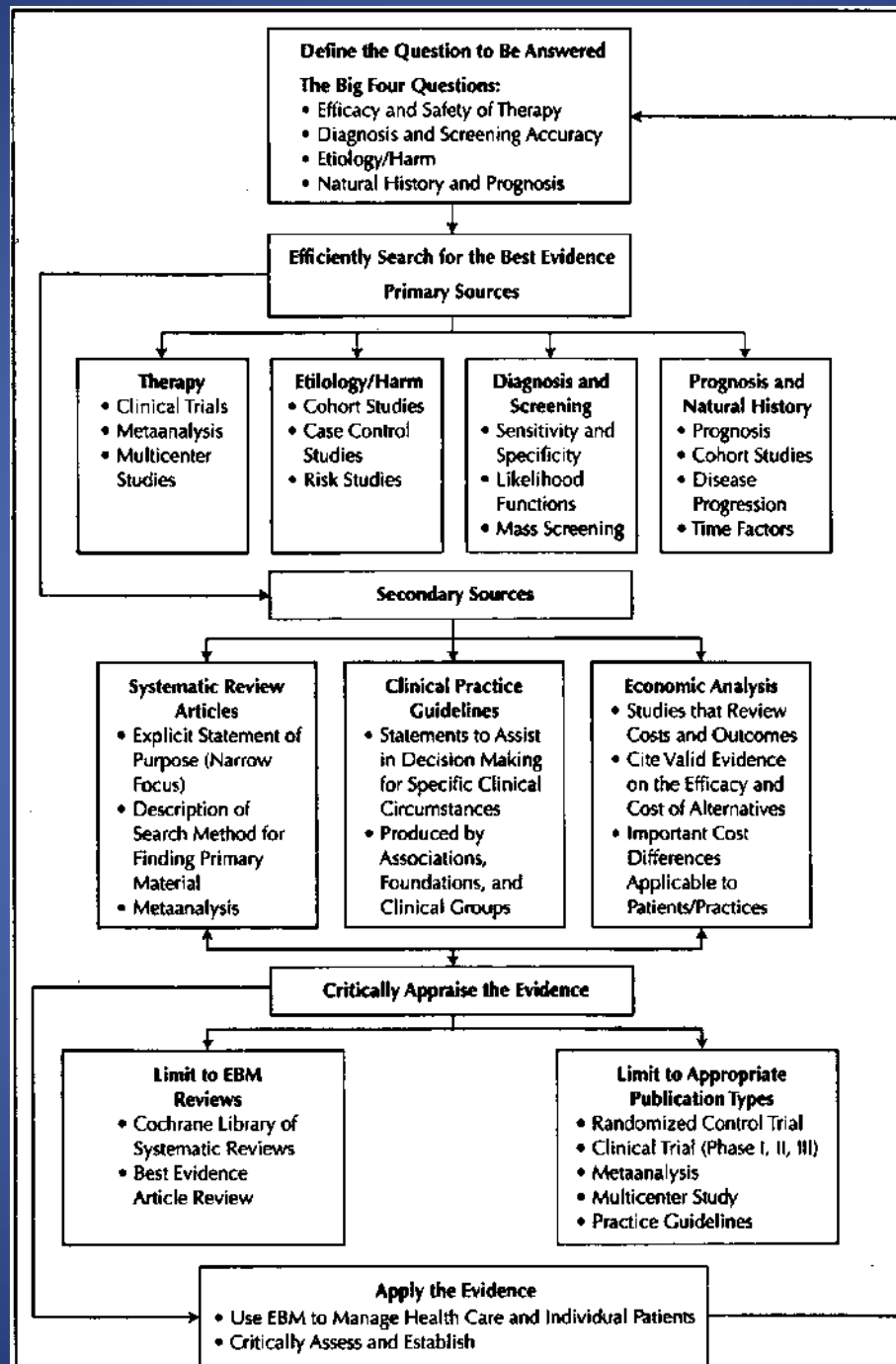
- Other good sources include
  - Systematic reviews
  - Clinical practice guidelines
  - Evidence-based services
    - UpToDate
  - CDC
  - NIH

Best Evidence



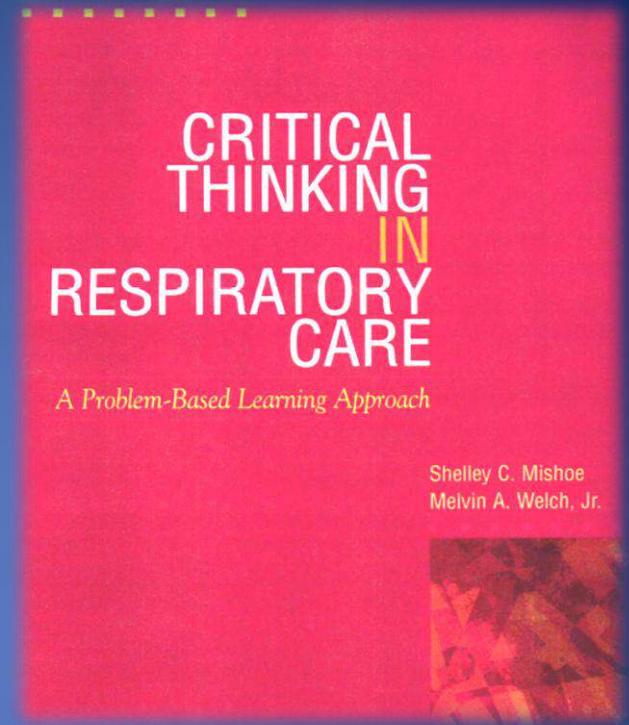
# Evidence Sources

- Clinical Evidence: [www.clinicalevidence.org](http://www.clinicalevidence.org)
  - Focus: Primary Care
- Best Evidence: ACP Journal Club is [www.acponline.org](http://www.acponline.org)
  - Focus: Common medical problems in adult medicine
- Cochrane Library: [www.cochranelibrary.com](http://www.cochranelibrary.com)
  - Focus: Treatment and prevention
- MEDLINE: [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)
  - Search PubMed
- CINAHL



# PBL

- Uses a case study
- Asks the group to:
  - Prioritize
  - Make inferences
  - Anticipate findings
  - Solve problems
  - Anticipate problems & solutions
  - Make decisions
  - Reflect on outcomes and experiences





# Format to Record a Group's PBL Discussions

Biological		Clinical		Psychological
What do we know?	What do we need to know?	What do we hypothesize?	What do we recommend?	What topics will we research?

# CASE STUDY 1

## Carl Chills

### Case Scenario

- A 39-year-old computer programmer is admitted to your hospital via the ED. He is divorced and maintains custody of his two teenaged sons. Mr. Chills has health insurance through his company's PPO. His neighbor drove him to the ED because he felt too ill to drive. He states, "I feel tired, have bouts of chills and sweats, and keep coughing up brown-colored phlegm." Initially the cough was dry and nonproductive, but has become more persistent and productive during the last 24 hours. Onset of fever was noticed approximately 3 days prior to admission. Past medical and family history are not contributory to the current condition.

# CASE STUDY 1 (continued)

PHYSICAL ASSESSMENT		LABORATORY DATA	
<b>Vital Signs</b>	Temperature: 39°C; Pulse: 110/minute; Blood pressure: 125/85; Respiratory rate: 25/min.	<b>ABG, room air sample</b>	pH: 7.48; PaCO <sub>2</sub> : 30 mm Hg; PaO <sub>2</sub> : 58 mm Hg; HCO <sub>3</sub> <sup>-</sup> : 20 mEq/L.
<b>Inspection</b>	No central cyanosis. Normal chest/abdominal excursion.	<b>Chest radiograph</b>	Increased opacity noted throughout the right lower lobe.
<b>Palpation</b>	Asymmetry noted during thoracic expansion with a right-sided limitation. Increased tactile fremitus noted over the lower posterior right chest wall.	<b>PFT</b>	None ordered.
<b>Percussion</b>	Dull/flat noted upon percussion of the lower posterior right chest wall.	<b>CBC</b>	RBC, hemoglobin, and hematocrit all within normal limits. WBC: 20,000/mm <sup>3</sup> with neutrophils at 85% of the differential.
<b>Auscultation</b>	Bronchial breath sounds heard over the lower posterior right chest wall with discordant crackles.		

# Critical Thinking Exercise 1

## PRIORITIZING PATIENT CARE

Explain how you would prioritize your assessment of this patient based on his admitting data.

# Critical Thinking Exercise 2

## MAKING INFERENCES BY CLUSTERING DATA

- a. What inference can you make about the possible diagnosis?
- b. Practice clustering the data that lead you to this inference and describe how each piece of data contributed to your hypothesis.

# Critical Thinking Exercise 3

## ANTICIPATING FINDINGS

- a. What laboratory and diagnostic data would be of further assistance in assessing this patient?
- b. What specific findings do you anticipate and how would they guide your management of this patient?

# Critical Thinking Exercise 4

## PROBLEM SOLVING USING CLINICAL DATA

- a. What does the laboratory and diagnostic data suggest about this patient's diagnosis? Explain the rationale for your interpretation.
- b. What additional data would you request to assist in making your diagnosis? Explain the rationale for each procedure or test.



# Critical Thinking Exercise 5

## ANTICIPATING PROBLEM AND SOLUTIONS

- a. How would you track this patient's clinical progress?
- b. What pulmonary complication may develop during this patient's clinical course?

# SOAP Note and Care Plan

- S:** “I feel tired, have bouts of chills and sweats, and I keep coughing up brown-colored phlegm.”
- O:** Temperature: 39°C; HR: 110/min; BP: 125/85; RR: 25/min. Inspection findings are normal. Palpation reveals right-sided limitation upon expansion and increased tactile fremitus in right lower posterior chest wall. Flat percussion note in right lower posterior chest wall. Bronchial breath sounds in right lower posterior chest wall with discordant crackle. ABG results: pH: 7.48; PaCO<sub>2</sub>: 30 mm Hg; PaO<sub>2</sub>: 58 mm Hg; HCO<sub>3</sub><sup>-</sup>: 20 mEq/L. CXR results: RLL opacity. CBC results WBC: 20,000/mm<sup>3</sup>, 85% neutrophils.
- A:** The patient is febrile (39°C) and tachypneic (25/min).  
The limited right-sided expansion and increase tactile fremitus indicate consolidation. The percussion and auscultation findings are also indicative of consolidation with airway secretions, as evidence by the bronchial breath sounds and presence of crackles. ABG results reveal a partially compensated respiratory alkalemia (alveolar hyperventilation) with moderate hypoxemia. CXR results indicate a RLL infiltrate. CBC results denote leukocytosis with neutrophilia.  
*These findings are consistent with bacterial pneumonia.*
- P:** Begin oxygen via nasal cannula at 4 L/min per protocol to maintain SpO<sub>2</sub> ≥92%. Follow-up with ABG on oxygen. May monitor with pulse oximeter. Institute bronchial hygiene per protocol.

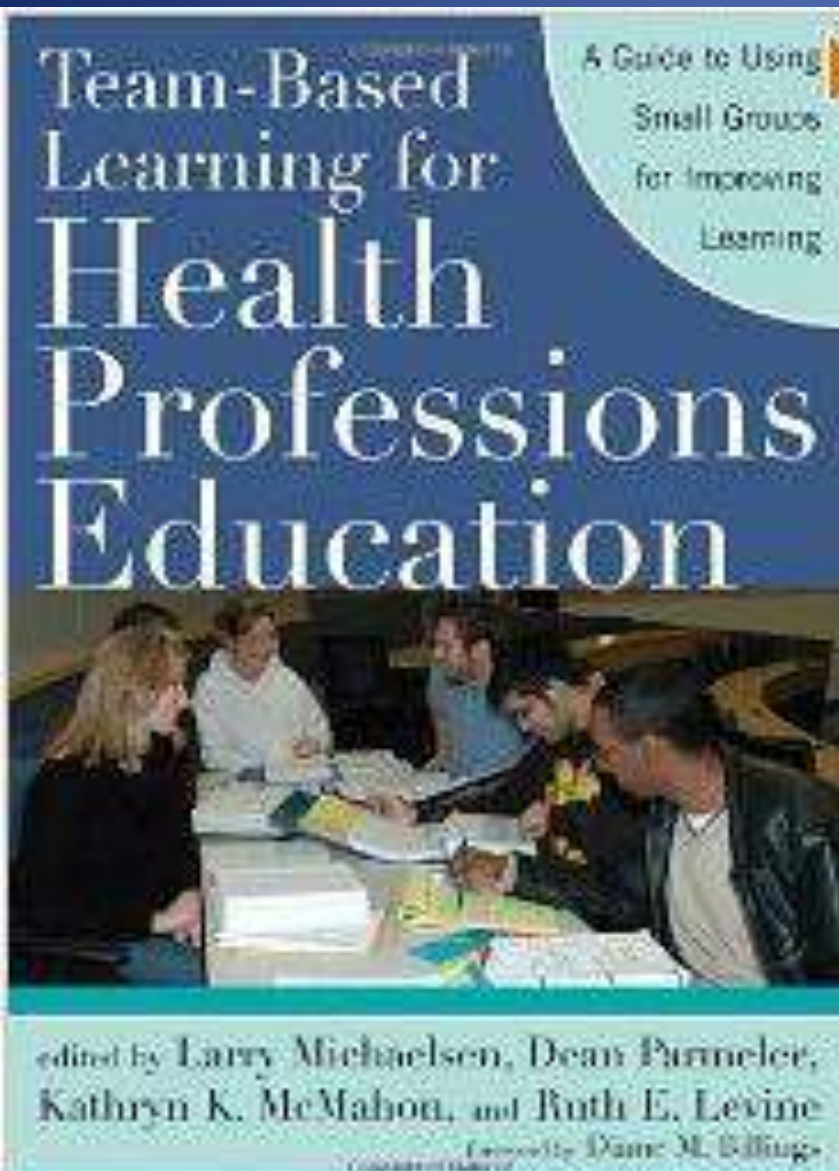
# Critical Thinking Exercise 5

## DECISION MAKING AND REFLECTION

- a. Discuss the average length of stay (LOS) you would expect for this patient, Mr. Chills.
- b. Estimate the direct and indirect costs for acute care based on your care plan and your understanding of the treatment for bacterial pneumonia.
- c. Finally, estimate if your hospital can make a profit in this case if the PPO-negotiated payment is based on the DRG.

2008

# Team Based Learning



## PART ONE: FUNDAMENTALS

- 1 Team-Based Learning in Health Professions Education  
**Why Is It a Good Fit?**  
*Dean X. Parmelee*
- 2 Fundamental Principles and Practices of Team-Based Learning  
*Larry K. Michaelsen and Michael Sweet*
- 3 Creating Effective Team Assignments  
*Larry K. Michaelsen and Michael Sweet*
- 4 Improving Critical Thinking Skills in the Medical Professional With Team-Based Learning  
*Herbert F. Janssen, N. P. Skeen, John Bell, and William Bradshaw*
- 5 An Educational Rationale for the Use of Team-Based Learning  
**Didactic Versus Dialectic Teaching**  
*Herbert F. Janssen, N. P. Skeen, R. C. Schutt, and Kathryn K. McMahon*
- 6 Team Formation  
*Kathryn K. McMahon*
- 7 Team Maintenance  
*John W. Pelley and Kathryn K. McMahon*
- 8 Facilitator Skills  
*John W. Pelley and Kathryn K. McMahon*
- 9 Peer Evaluation in Team-Based Learning  
*Ruth E. Levine*
- 10 Research and Scholarship  
**Team-Based Learning in Health Professions Education**  
*Paul Haidet, Virginia Schneider, and Gary M. Onady*

# Clinical Simulation

- “The techniques of imitating the behavior of some situations or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personal training”
- Available in 1960’s
  - wide spread use after 2000
- Improves patient outcomes
  - “mock codes” → actual code survival rates improved from 33% to 50%
- Improves education
- Effective assessment tool

Orledge J, Phillips WJ, Murray WB, Lerant A. The use of simulation in healthcare: from systems issues, to team building, to task training, to education and high stakes examinations. *Curr Opin Crit Care*, 18(4), 326-332, 2012.

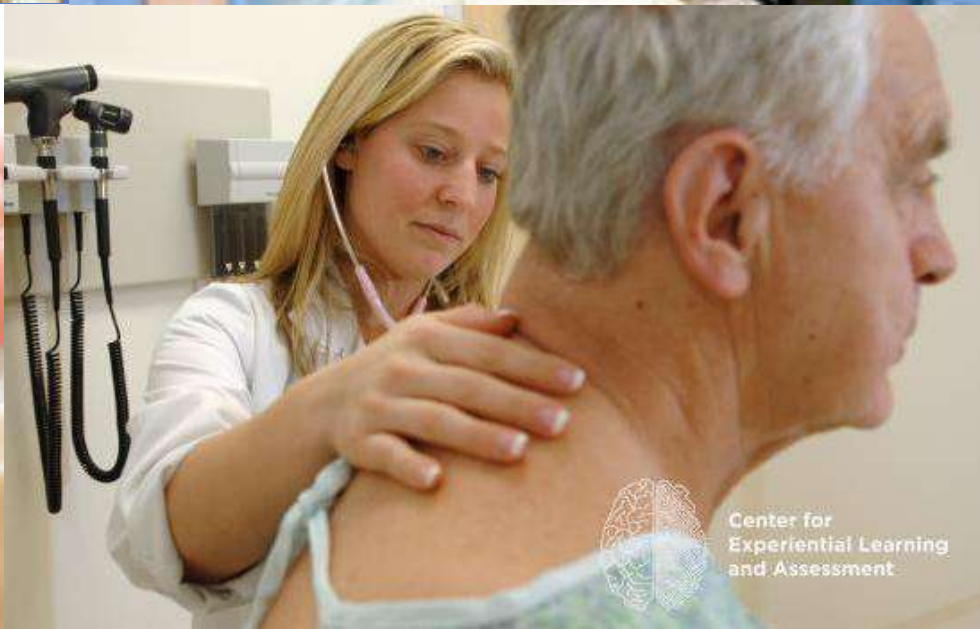
# High Fidelity Simulation

- Fidelity
  - High fidelity- full body mannequin with physiologic modeling software, pulses, breath sounds, ECG, and vascular pressure outputs
  - Low fidelity- CPR mannequin
- Task training- intubation mannequin, bronchoscopy
- Standardized Patients









Center for  
Experiential Learning  
and Assessment

# Simulation and Critical Thinking

- “Human patient simulation is an effective learning technique in pre-licensure nursing students”
- Gains in knowledge are documented
- There were no statistically significant gains in critical thinking using the Health Science Reasoning Test (HSRT)

Shinnick MA, Woo MA. The effect of human patient simulation on critical thinking and its predictors in prelicensure nursing students. Nurse Education Today, 2012 (article in press).

# Simulation and Critical Thinking

- There may be a relationship between general critical thinking skill and student performance on simulation problems<sup>1</sup>
- High fidelity simulation allows students to practice rare, high risk or complex situations without compromising patient safety<sup>2</sup>

1. Fero LJ, O'Donnell JM, Zullo TG, Dabbs AD, Kitutu J, Samosky JT, Hoffman LA. Critical thinking skills in nursing students: comparison of simulation-based performance with metrics. *Journal of Advanced Nursing*, 66(10), 2182-2193, 2010.
2. Lewis R, Strachan A, Smith MM. Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *The Open Nursing Journal*, 6, 82-89, 2012.

# Flipping the Classroom



**Move lecture material  
out of the classroom  
through online delivery.**

**Move “homework”  
into the classroom  
where the instructor  
can serve as “guide.”**

**Extend conversation  
outside of class through  
threaded discussion**

**Use opened up time  
for discussion and  
practice.**





# Flipping the Classroom

- In 2004, Salman Khan began to record videos at the request of a younger cousin who felt that if the lessons were recorded she could skip through parts she had mastered, yet replay other parts that were troubling her to learn.
  - Khan Academy videos have been used by some educators as part of their flipped teaching strategy.
- "The Classroom Flip" (2006), authors Mike Tenneson and Bob McGlasson



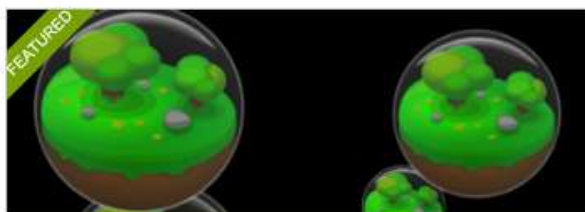
204,479,457 lessons delivered

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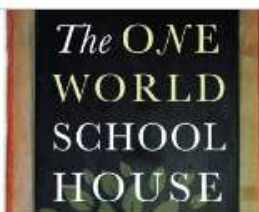
Learn almost anything for free



### Explore computer science

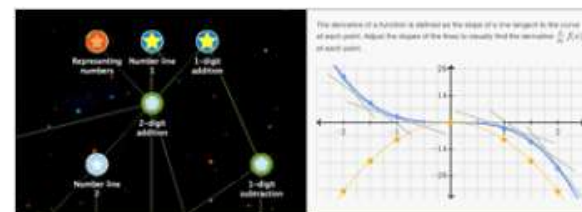
Create beautiful art and design your own simulations while learning how to program.

SALMAN KHAN  
talks about  
his new book  
with Air Talk's  
LARRY MANTLE



### Education Reimagined

Founder Sal Khan talks about how learning is being transformed in classrooms.



### Practice your math skills

Practice your math skills from addition to calculus and everything in between.

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## Math

[Arithmetic and Pre-Algebra](#) , [Algebra](#) , [Applied Math](#) , [Geometry](#) , [Trigonometry](#) , [Probability](#) , [Statistics](#) ,  
[Precalculus](#) , [Calculus](#) , [Differential Equations](#) , [Linear Algebra](#) , [Brain Teasers](#) , [Vi Hart](#)

## Science

### Log in to Khan Academy

[Log in, it's free](#)

Create a profile, save your work, and earn badges.

OR

# Flipping the Classroom

- A method to move from lecturer to facilitator in class.
- Reduce (or eliminate) time spent in-class on lecture
- Opening up class time for the use of active learning strategies
  - Critical thinking
  - Problem solving
- Use web-based technology to deliver content instruction
  - Camptasia screen capture and recording technology for recorded lectures



# Flipping the Classroom

- Class discussion on complex problems
- Questions that involve reasoning skills, critical thinking and the ability to organize and articulate knowledge
- Small-group activities, problems, cases
- Role-playing, debate, use of case studies, journals, articles
- Formal/informal writing assignments or brief case studies in class

# The Interactive Classroom

- Use traditional classroom lectures (Powerpoint slides)
- Intersperse problems, questions and brief case example
- Use technology to obtain and give immediate feedback and stimulate discussion
- “The Audience Response System” or “Clicker”

# Turning Technologies: Turning Point

- Clickers
  - Audience Polling system
  - Classroom response systems
  - Audience response system
- Device
  - Handheld pocket size
  - Remote control
  - ResponseCard IR
    - Infrared signals
    - Radio frequency



# Turning Technologies: Turning Point

- Hardware
  - Clickers: ResponseCard IR
  - RF Receiver
- Software
  - Turning point: Interactive PowerPoint
  - CD/Website
    - Installs unto your desktop
    - Set frequency



[www.turningtechnologies.com](http://www.turningtechnologies.com)

# Clickers in the Classroom

- Uses and benefits
  - Students may come to class better prepared
    - Review notes, read assigned chapters
    - Do the homework
    - Develop and ponder questions
  - May improve student satisfaction and attendance
  - Promote interaction between students and teacher
  - Immediate feedback and assessment
  - May promote/improve critical thinking and problem solving

# Approach to Clinical Diagnostic Thinking

## 1. Identify the Problem

- Chief complaint
- Patient profile

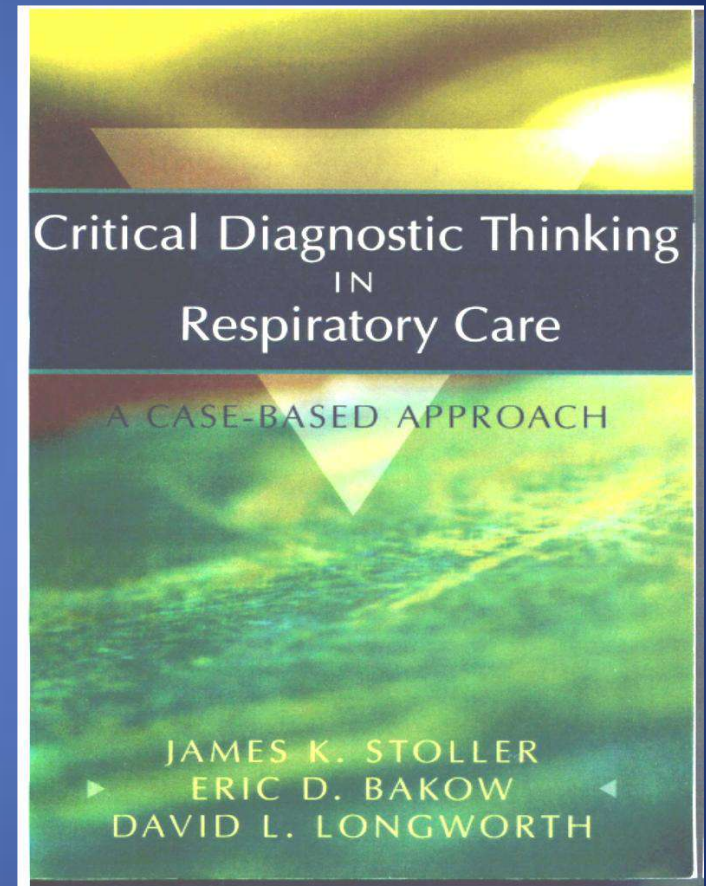
## 2. Gather information

- Chart review
- History
- Review of symptoms
- Physical exam
- Diagnostic testing

## 3. Formulate and test hypothesis

## 4. Make Diagnosis

## 5. Monitor and re-evaluate



# Key Elements of Critical Diagnostic Reasoning

1. Identify the problem
2. Gather additional information
3. Formulate and test hypothesis
4. Make diagnosis
5. Monitor and re-evaluate

# Key Elements of Critical Diagnostic Reasoning

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# Case 1

Mr.. Wilson works as an insurance agent. He is a 50 year old, 172 lb Caucasian male with a 5 month history of daily non-productive cough, which is worse at night. He also complains of some voice raspiness which was treated in the past with medication and counseling for life style changes.

# Step 1: Identify the Problem

## Question #1

1. What is the patients chief complaint?
  - A. Voice raspiness
  - B. Chronic cough
  - C. Sputum production
  - D. Hemoptysis

# Step 1: Identify the Problem

## Question #1

1. What is the patients chief complaint?
  - A. Voice raspiness
  - B. Chronic cough**
  - C. Sputum production
  - D. Hemoptysis

## Step 2: Gather Information

2. At this time, all of the following information should be gathered **EXCEPT**:

- A. Sputum Production or Hemoptysis
- B. Dyspnea
- C. Pulmonary Function Testing
- D. Wheezing, Whistling or Chest Pain
- E. Smoking History

## Step 2: Gather Information

2. At this time, all of the following information should be gathered **EXCEPT**:

- A. Sputum Production or Hemoptysis
- B. Dyspnea
- C. Pulmonary Function Testing**
- D. Wheezing, Whistling or Chest Pain
- E. Smoking History

## Step 2: Gather Information

Cough: 5 month, daily, worse at night, some voice raspiness

Sputum Production: Non productive

Hemoptysis: No

Wheezing, Whistling or Chest Tightness: No

Chest Pain: None

Breathlessness: None

Smoking History: Never smoked

Pulmonary History: No other prior lung problems

Other: Hypertension - treated with beta blocker, no ACE inhibitor, no heartburn, no known reflux

# Step 3: Formulate and Test Hypothesis

## Question #3

What are the most common causes of chronic cough?

- A. Asthma (hyperactive airways)
- B. Bronchitis
- C. Post nasal drip
- D. GI reflux (GERD)
- E. All of the above

# Step 3: Formulate and Test Hypothesis

## Question #3

What are the most common causes of chronic cough?

- A. Asthma (hyperactive airways)
- B. Bronchitis
- C. Post nasal drip
- D. GI reflux (GERD)
- E. All of the above



# Step 3: Formulate and Test Hypothesis

## Question #4

What are less common causes of chronic cough?

- A. ACE inhibitor drugs
- B. Endobronchial lesions
- C. CHF
- D. ILD
- E. All of the above (plus bronchiectasis)

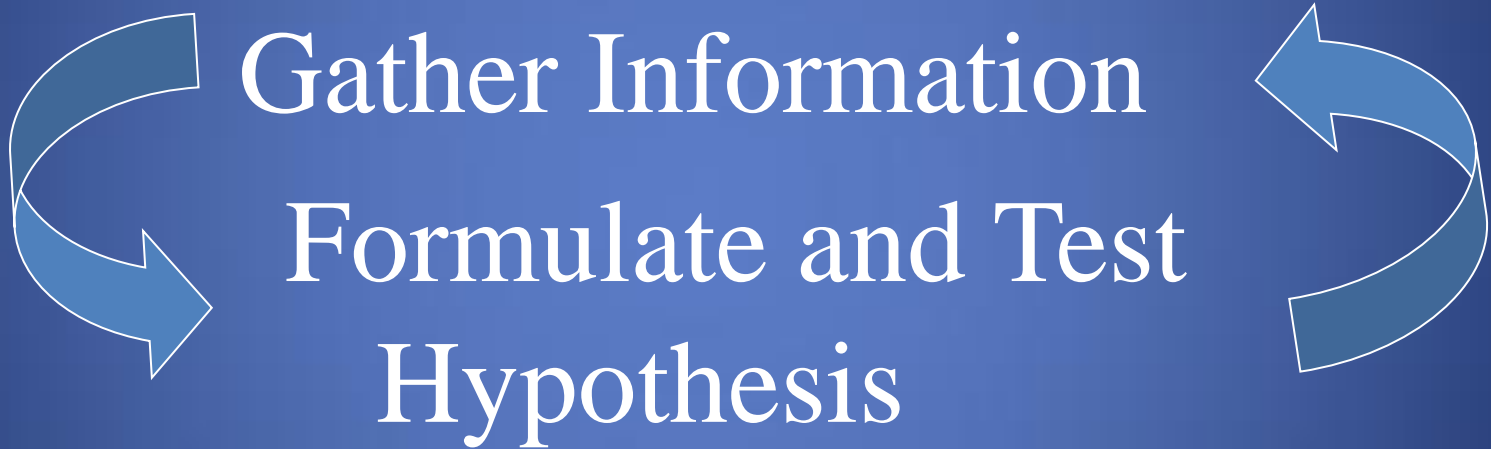
# Step 3: Formulate and Test Hypothesis

## Question #4

What are less common causes of chronic cough?

- A. ACE inhibitor drugs
- B. Endobronchial lesions
- C. CHF
- D. ILD
- E. All of the above (plus bronchiectasis)

# Critical Diagnostic Thinking



# Physical Examination

**General Appearance:** Patient is awake, alert, sitting quietly, in no apparent distress. Patient appears to be well nourished, of appropriate weight for his size.

## **Vitals:**

- **BP:** 155/88;
- **HR:** 82
- **Respiratory Rate:** 14bpm;
- **Temp:** 98.6 F

**Extremities:** NO edema or cyanosis, good capillary refill.

# Physical Examination

**Inspection:** Clear sinus discharge, no accessory muscle use, no retractions, normal respiratory rate and depth, thorax appears normal, no pursed lip breath or cyanosis.

**Palpation:** No sinus tenderness, good bilateral chest expansion, no tactile vocal fremitus, tracheal deviation, subcutaneous emphysema or lymphadenopathy.

**Percussion:** Chest resonant to percussion throughout.

**Auscultation:** Breath sounds clear, no adventitious breath sounds noted.

# Step 3: Formulate and Test Hypothesis

## *Chronic Cough Likely Suspects*

Post nasal drip (sinusitis, allergic rhinitis)

Smoking

Asthma

COPD

Chronic bronchitis, CF, Bronchiactisis

GI Reflux - GERD

Type I ACE Inhibition

Neoplasms

Abscess

Aspiration, Infection (pneumonia, T.B.)

## Step 3: Formulate and Test Hypothesis

### Question #5

Which of the following is the most likely cause for the chronic cough in this patient:

- A. Asthma
- B. Bronchitis
- C. Post nasal drip
- D. GI reflux
- E. COPD



## Step 3: Formulate and Test Hypothesis

### Question #5

Which of the following is the most likely cause for the chronic cough in this patient:

- A. Asthma (no wheezing)
- B. Bronchitis (no smoking, lung problems)
- C. Post nasal drip (discharge, worse at night)
- D. GI reflux - GERD (denies)
- E. COPD (no smoking, previous lung problems)

# Gather Information

## *Diagnostic Testing*

Which of the following would you suggest at this time?

- A. PFTs
- B. CXR
- C. ABG
- D. Oximetry

# Gather Information

## *Diagnostic Testing*

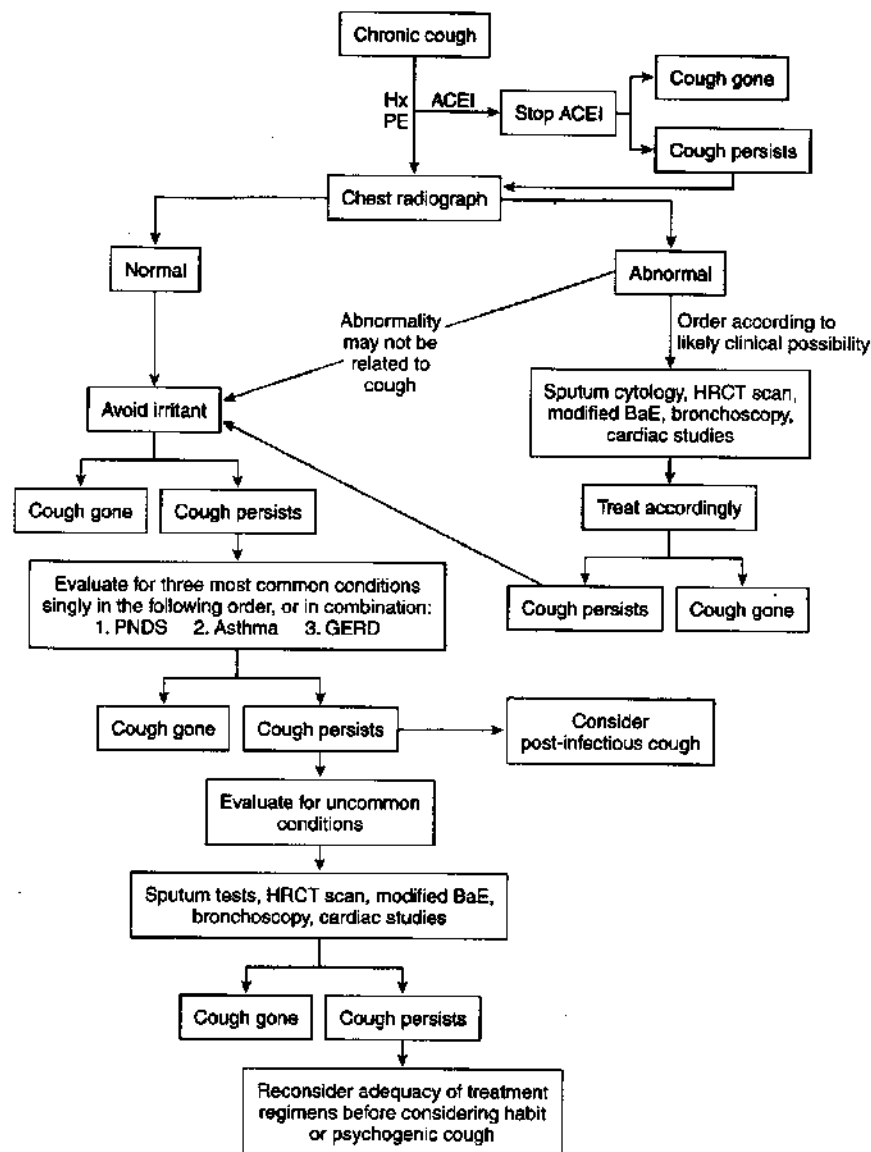
Which of the following would you suggest at this time?

A. PFTs

**B. CXR**

C. ABG

D. Oximetry



▼ Figure 2-1 Guidelines for evaluating chronic cough in immunocompetent adults. ACEI, Angiotensin-converting enzyme inhibitor; BaE, barium esophagography; GERD, gastroesophageal reflux disease; HRCT, high-resolution computed tomography; Hx, history; PE, physical examination; PNDS, post-nasal drip syndrome. From Irwin RS: *Chest* 114(suppl):166S, 1998.

# Gather Information

## *Diagnostic Testing*

- A. PFTs → FEV<sub>1</sub> & FVC → Normal; FEV<sub>1</sub>/FVC → 80%;  
No improvement post bronchodilator
- B. CXR → Clear
- C. ABG → .21/85/7.42/36
- D. Oximetry → SpO<sub>2</sub> = 95%

## Step 4: Make Diagnosis

**Post-nasal Drip:** Non-productive cough, worse at night; clear nasal discharge; no sinus tenderness

**Smoking:** No history

**Asthma:** No wheezing, whistling or chest tightness

**COPD (chronic bronchitis, other):** No sputum production, no smoking history, no dyspnea

**GI Reflux (GERD):** Denies

**ACE Inhibition:** No

**Neoplasm:** CXR clear

**Abscess:** CXR clear

**Aspiration/Infection:** CXR clear, no problem with unconsciousness

**Fibrosis:** CXR clear

# Step 4: Make Diagnosis

Post nasal drip → treat and follow (nasal corticosteroid, nonsedating antihistamine)

Asthma → spirometry, pre/post bronchodilator, methylcholine challenge

GI reflux (GERD) → The diagnosis of GERD can be based upon clinical symptoms alone; lifestyle and dietary modifications along with antacids and nonprescription histamine-2 (H2) receptor antagonists are usually sufficient.

Other possibilities:

- Subclinical CHF

- Endobronchial lesions → bronchoscopy



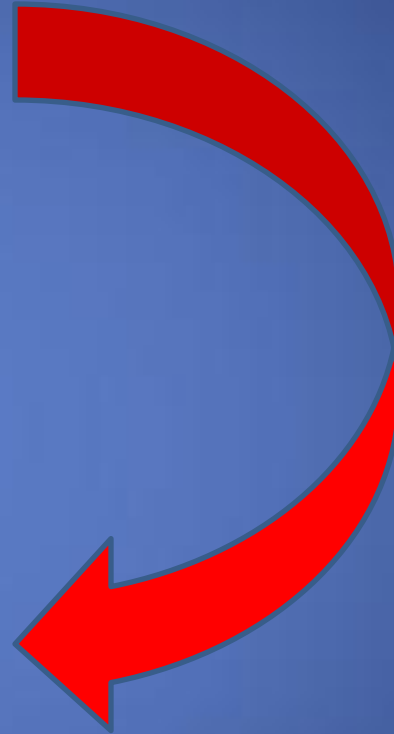
## Step 4: Make Diagnosis

Decision was made to place the patient on

- nasal corticosteroid
- nonsedating antihistomine and
- follow.

# Teaching Critical Thinking

- Methods
  - Problem-based learning
  - Team-based learning
  - Case-based learning
  - Simulations
    - High fidelity
    - Standardized patients
  - Flipping the classroom
  - Audience response systems
- Student evaluation
  - Multiple choice testing
  - Rubrics
  - Simulations
  - Projects (case presentations, capstone projects)



# Critical Thinking in Respiratory Care

- What is it?
- Why is it important?
- Can you measure it?
- Can you teach it?
- Methods
  - Problem and case based learning
  - Simulations
    - High fidelity
    - Standardized patients
  - Flipping the classroom
  - Student evaluation
- Critical diagnostic thinking
  - Identify the problem
  - Patient history and physical
  - Formulation and evaluation of hypothesis
  - Laboratory evaluation
  - Assessment of the effect of therapy
  - Pitfalls and common mistakes
- Summary and conclusions