

# Introduction to "Clinical Problem Analysis"

According to Slavin, in Educational Psychology - Theory and Practice, problem solving is the application of knowledge and skills to achieve certain goals.

As students progress from the second year of medical school to the "clinical years", it is apparent that a good fund of knowledge is essential but not sufficient for good clinical problem solving.

There are a number of ways one could learn problem solving. Mandin (1) believes that problem solving is case specific. He suggests that it may be most effective to teach students "**schemata**" which are **specific to different types of cases**. Schemata are strategies used to organize data. For example, a way to organize the differential diagnosis of bloody urine would be to think of the conditions that originate from the kidney, the ureter, the bladder, and finally, the urethra. These larger categories become the "name of the folder" that you would put specific diagnoses into. For example, under the heading, "Kidney" you would put trauma, glomerulonephritis, etc. Custers (2), on the other hand, believes there are certain analytic steps in a standard analytic model that are "universally" helpful in solving clinical problems. We believe that both philosophies are useful.

In this session, we will be focusing on a model of "Clinical Problem Analysis" that we believe, provides a useful way to approach most patients' problems. As you read the steps in this model, you will notice that it is written in a very linear manner, going from steps 1 through 6. In reality, the steps in the model are most often used in an iterative manner. After going through one or two steps, one often goes back to previous steps before going on. For example, while taking a history you get ideas about diagnoses that may explain a patient's problem. You then go back and take some more history to test your hypotheses before going on to synthesize all your findings. As more data comes in you may generate more hypotheses and then gather more data.

## Overview of Clinical Problem Analysis\*

1. Initial Data Gathering using "scanning history"  
Use strategies for general data gathering:
  - Seven cardinal features
  - PMH/Meds/Allergies/FH/SH
2. Identify the key problem/s
3. Generate conditional hypotheses  
Use strategies to help generate hypotheses:
  - Systems Approach
  - Anatomic Approach
  - Pathophysiologic Approach
  - General Classes of Disease
4. Gather further data guided by hypotheses  
Use strategies designed to help explore hypotheses:
  - Pertinent Review of Systems - ROS questions in the relevant systems
  - Pertinent FH/SH/Risk factors
  - Diagnosis-specific questions designed to identify the specific disease or condition.
5. Formulate a solution - Use strategies to synthesize findings and differentiate problems:
  - A. List Findings
  - B. Group Findings
  - C. Generate Problem List
  - D. Generate Differential Diagnoses
  - E. Order Differential Diagnoses (by probability, epidemiologic clues, pattern recognition, and "relative value")
  - F. Develop Action Plans
    1. Diagnosis
    2. Treatment
    3. Monitor for:
      - a. Complications of disease
      - b. Complications of treatment
      - c. Improvement
6. Reflection

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\*Adapted from Custers: Academic Medicine 75(3):291 3/2000

"Clinical Problem Analysis: A Systematic Approach to Teaching Complex Medical Problem Solving."

## Summary of Clinical Problem Analysis

### 1. **Initial Data Gathering using the “scanning” history-** (PE and Labs will come later)

Scanning history includes:

- Chief complaint
- Seven cardinal features
- Meds
- Allergies
- PMH, PSH, FH, and SH.

This phase of data gathering is aimed at building a basic database and is not addressing any hypothesis. This part of the history is called a "scanning history" because you are scanning or searching for data. You are using questions designed to get the patient's "story". The Cardinal 7 characterizes the patient's problem(s) and the other questions begin to fill your database with potentially useful information. Note that the only difference between the “scanning” history and the HPI that you have been taught is the reason that you are collecting the information. In the “scanning” history you are collecting the information by rote to insure that you have complete data, while in the HPI, you collect medication, allergies, PMH, PSH, FH, and SH if it is related to the chief complaint. In the HPI, you need to decide whether it relates to the chief complaint, and then decide to collect the information if it is pertinent.

### 2. **Identify the Problem(s)**

Here you must figure out what problem it is that you must solve:

- When a patient has initiated an encounter the problem is usually the patient’s chief complaint/s.
- Other times the clinicians identifies a problem not explicitly stated by the patient, but is identified by you or a family member. For example:
  - Nonadherence with medication leading to medical problems or complications (failure to take prescribed antibiotics leading to failure to improve)
  - Delirium
  - Psychiatric problems

### 3. **Generate conditional hypotheses** (See glossary)

Conditional hypotheses are most often possible diagnoses (See glossary)

It is not always necessary to come up with every possible diagnosis. One often begins by thinking about what the most likely possibilities are. Also think about any diagnoses that are dangerous, that you would not want to miss. Remember diagnoses can range from very specific (e.g. grade III sprain of the right medial collateral ligament) to very general (e.g. psychiatric problem).

So, why do we generate these hypotheses even before we have finished the history? The reason is that it tells you what further information you need. It drives the data gathering process. It allows you to ask more focused questions to help you then decide which of the possible diagnoses are most likely.

Below are some strategies that will help you recall specific diagnoses that are pertinent to the patient's complaint and to identify broad diagnostic categories that may be helpful (e.g. musculoskeletal, psychiatric, inflammatory, etc.) These strategies work because they give you a way of organizing your thinking. They help you to open up a mental "file drawer" in which a likely diagnosis may be filed away. They may also help you figure out what "systems" the problem may lie in, allowing you to ask questions that will help narrow down the system or the diagnosis. Even if you don't know the specific diagnosis, if you know the system, it is much easier to look up the information in a book or article.

Some common strategies include:

- **Systems Approach:** Think of the possible "systems" which may be related to the patient's symptoms (i.e. for most complaints of lower abdominal pain: GI, GU, and GYN. You can then ask a "Pertinent Review of Systems" where you ask the ROS questions from the systems that may be related to the patient's problem.
- **Anatomic Approach:** Think anatomically. For example, when thinking about right upper quadrant or epigastric abdominal pain, what structures are there? This would lead to thinking about diseases of the gall bladder, liver, pancreas, stomach, and maybe the kidney.
- **General classes of disease:** For example, acute infectious diarrheas, dementias, vascular problems, toxins, etc.
- **Pathophysiologic Approach:** For example, when thinking about jaundice, you should think about how bilirubin is produced, and how it is metabolized and excreted. Once you outline the pathway, ask, "What can go wrong?" In other words, jaundice may be caused by a problem anywhere along that path.

#### 4. **Gather further data guided by your hypothesis**

Your findings become your "Pertinent Negatives and Positives" to be used later on in the problem solving process and often presented as part of the history.

- "Relevant Review of Systems": These are ROS questions in the systems that are likely to be causing the patient's condition. For example, if the patient had shortness of breath, you would ask questions from the cardiovascular and pulmonary review of systems. A comprehensive set of conditional hypotheses would also include anemia, so the hematologic review of systems would also be relevant.
- "Diagnosis-specific Questions" designed to identify the specific disease: These questions are ones which may require more in depth knowledge of specific diseases or that you may generate by considering pathophysiology. When you gather data based on your knowledge of specific pathologic conditions or classes of diseases you are gathering "Condition Specific Data". For example, if you think that a patient's nasal congestion may be secondary to allergies you should ask about other symptoms and history relevant to allergies (sneezing, itching, family history of allergies, etc).

## 5. **Formulate a Solution** (synthesize and differentiate)

Once data has been gathered, it is necessary to *put it all together*; to *synthesize the data*; to *integrate the data with past experience and knowledge*.

The following is a list of steps that the clinician/student can use to enhance problem solving.

### A. List Findings

List the important positive and negative findings all together. The goal here is to get the important information close together in a format that is easily read and reviewed. We want to separate the wheat from the chaff. With the information all together, it is easier to make connections.

The "important findings" fall into 3 main groups:

1. Risk factors: age, sex, and other relevant epidemiologic risk factors (e.g. diet, exercise, family history of a disease, etc.).

These factors influence the likelihood that a given condition exists. The particular risk factors that are included depend on what conditions you are worried about. Age is always relevant. The specific diseases a patient is likely to have are largely age related (not too many children get heart attacks).

2. Specific symptoms, physical exam findings, and lab test results if available.

These factors can help tell you whether the patient actually has the condition in question. List most of the positive findings and VERY important negative findings (if you suspect cystic fibrosis and the patient had a negative lab test for this condition, that's important)

3. Other elements of the history that may be may be relevant to the main problem: Medications, some past surgeries and diagnoses, allergies,

### B. Group Findings

The data from all aspects of data gathering should now be synthesized into "problems" stated with the greatest degree of specificity possible. The goal here is to bring "Listed findings" (connected symptoms, physical findings, laboratory data, age and risk factors) together into unifying hypotheses. You will use these elements of the history to guide your thinking and support your hypothesized groupings. You are categorizing the data. You're making connections. You are generating problems that will go on the Problem List.

How do you group findings into problems to be included on a Problem List?

- Some problems may be clearly stated as a diagnosis if the data supports that single diagnosis. In other words, you are bringing the "Listed Findings" together into a unifying hypothesis. For example, crushing chest pain radiating down the left arm, shortness of breath, diaphoresis, tachycardia, with EKG changes showing myocardial ischemia are readily grouped together as a tentative diagnosis of "Myocardial Infarction". The presence of risk factors of male sex, older age, and smoking increase the likelihood of this diagnosis and support the selected grouping.
- Other problems may be stated as clusters of symptoms and findings that you believe go together but could be caused by more than one disease. For example: fever, cough, and fatigue may go together because they began at the same time in a patient and can be related to a variety of pulmonary infections, but you may not feel very certain yet about a specific diagnosis. So just list the cluster of findings as a problem.
- Use knowledge of the basic, clinical and behavioral sciences to figure out which groupings make sense (e.g. you have learned that vomiting, headache, and double vision occurring together fit with increased intracranial pressure).

C. Generate a Problem List (See Glossary for complete definition)

A problem list is a summarization tool used frequently by most physicians practicing in a wide variety of settings. There are as many variations of the basic problem list as there are different settings in which physicians practice.

A typical working problem list for an outpatient encounter would include the following types of items:

- Current active problems (the product of listing and grouping).  
These may be listed as any of the following:
  - A single symptom (e.g. cough), sign, or test result that is felt not to be related to any other symptoms, signs or test results and for which specific diagnosis has yet been proposed.
  - A group of symptoms, signs, and/or test results (e.g. cough, chest pain, hemoptysis, rales, and pulmonary infiltrate) that are felt to likely be related, but for which no specific diagnosis is proposed.
  - A diagnosis (e.g. pneumonia) (Remember there is a wide spectrum of types of diagnoses ranging from broad disease categories to specific diseases)
- Relevant past medical diagnoses, chronic conditions, and surgeries.
- Relevant psychosocial factors
- Allergies and important adverse reactions to medication
- Relevant family history
- Relevant risk factors

D. Generate Differential Diagnoses (See Glossary)

- Generate a short list of differential diagnoses for each item on the problem list. This step helps you completely think through all of the problems. Even fairly specific diagnoses may warrant a differential. For example, if you have a patient with hypertension, you must ask, "What are the possible causes of hypertension?". Hypertension is an example of a syndrome, not a disease. You do not want to miss a correctable cause.
- When you are doing a write-up, the differential diagnosis along with a brief discussion of your rationale for the selected diagnoses can be written in an Assessment section underneath each problem (See Glossary for an example)
- There are many strategies one can use to generate differentials. See section on "conditional hypotheses" and Glossary definition of differential diagnosis.

E. Order the Differential Diagnoses under each problem by likelihood and seriousness of each condition. Here is where you are figuring out which of your hypotheses are more likely and which are less likely.

**What goes into your ordering a differential?**

- Probability: Common things happen commonly  
Use epidemiologic clues (smoking dramatically changes the probability of developing lung cancer).
- Pattern recognition: How well does this patient's findings fit this condition?
- "Relative value" of a diagnosis (a less common but very serious and treatable condition may be placed higher on your list).

F. Action Plan

There are three components to an action plan:

1. Diagnosis: What do I need to do to confirm or make the diagnosis?
2. Treatment: What do I need to do to treat this patient.
3. How will I monitor for:
  - The complications of the disease
  - The complications of the treatment
  - Improvement

**6. Reflection**

Questions to ask:

- Does this diagnosis make sense?
- Do you feel comfortable with this?
- Are the lab results what you expected?
- Is the clinical course what you expected?
- Did I "reach" this patient? Does the patient feel comfortable?

If the answer to any of the above questions is, "No", then rethink this case.



## PROBLEM-SOLVING CASE EXAMPLE

Chief complaint: Fever and sore throat.

HPI: 20 y.o. female with 3 day hx of fever, and sore throat, who presents today with dizziness. The sore throat is pretty bad. It's hard to swallow. Fluid intake is down but adequate. Urinating 3x so far today. She has some intermittent headaches that are not severe, and has a little cough. She had a low grade fever till last night when it went to 103.9 at which time she began hallucinating. She complained of dizziness (the room spins a little). There was no nausea. She feels very wobbly and fell twice in the last 12 hours.

Meds:

Motrin 200 mg q6h prn  
Tylenol 650 mg q4h prn  
"An herbal medicine"

SH:

Denies drug use.

PE:

General Appearance: Looks under the weather but cooperative. Gives good history although a bit sluggish.

VS: T 103.9; BP 90/58; P 96; RR 20.

HEEN: normal. Mucous membranes moist.

Throat: Red without pus

Neck: supple without adenopathy

Heart, Lungs, Abdomen: Normal

Gait: Wobbly, slow gait, normal Romberg.

Neuro: Otherwise normal.

Skin: Clear. Normal capillary refill.

**Solve the above problem using the "Clinical Problem Analysis" model. Since you have been presented with the data, begin with the "Formulate a Solution" Step.**

- Formulate a Solution
  - List Findings
  - Group Findings
  - Problem List
  - Generate Differential Diagnoses
  - Order Differential Diagnoses
  - Develop an Action Plan
- Reflection

Try this yourself before turning the page to see how the author solved this case.

## Formulate a Solution:

### List Findings

• 20 y.o. female	• Fever x 3d
• Sore throat x 3d	• Dizziness
• Hallucinations	• Fell x 2
• Red throat	• Wobbly gait

### Group Findings

- Pharyngitis (Sore Throat, fever, red throat)
- Hallucinations
- Dizzy (dizziness, fell x 2, wobbly gait)

### Problem List

- Pharyngitis
- Hallucinations
- Dizzy
- "20 year old female" [Think about the possibility of pregnancy and drugs]

**Generate Differential:** No attempt is being made here to be complete.

#### Pharyngitis

Strep, viral disease, or mono.

#### Hallucinations

High fever, encephalitis, drugs, or encephalopathy.

#### Dizzy

Orthostatic drop in BP 2° Flu (vasodilatation), dehydration, impending shock, or pregnancy.

### Order Differential

- Viral pharyngitis/strep/mono
- Hallucinations 2° high fever/drugs/encephalitis
- Dizziness 2° orthostasis (flu plus mild dehydration). Pregnancy possible (don't want to miss this). Impending shock unlikely.

### Action Plan

#### Diagnosis

TC/rapid strep, CBC, Mono spot, Advil, IVF

#### Treatment

IVF, Advil, ?Penicillin

#### Monitor

CNS, VS.'s, I/O's

### Reflect

- I'm worried about the dizziness & hallucinations. Can I be missing something? Is she sicker than I'm thinking?
- Response to treatment: After some fluids and Advil she looks and feels much better. Now I'm comfortable.

## Medical Problem Solving Glossary of Terms

**Conditional hypothesis:** A possible diagnosis that could explain a patient's history and findings as they have been revealed up to the point in time that the hypothesis is generated. The proposed diagnosis is considered possible, *given* the information available.

**Diagnosis:** Any proposed explanation for a patient's symptom/s, physical findings, and/or test results. To be useful a diagnosis must go beyond a simple description of the symptoms, findings and results to offer some synthesis that has some explanatory power. Diagnoses may range from general and rudimentary (e.g. fever due to some unknown infectious cause) to highly specific and sophisticated (e.g. active apical pulmonary tuberculosis with cavitation and positive smears for tubercle bacilli). Diagnoses can be specific diseases (e.g. pneumonia), syndromes (chronic fatigue syndrome), general classes of diseases (e.g. musculoskeletal disorder, psychiatric disorder), or psychosocial constructs with some explanatory potential (e.g. drug-seeking behavior, noncompliance).

**Differential diagnosis:** Differential diagnosis may be used to describe an exhaustive list of all possible diseases and syndromes which could be manifest by one or more of a patient's symptoms and findings, but more often it refers to *an abbreviated list of the most likely three or four diagnoses* which have emerged from a synthesis and analysis of the patient's symptoms, findings, and test results that are available at the time the differential is developed. Any type of diagnosis (see definition of diagnosis) may be included in a differential diagnosis.

There are textbooks and computer databases that can provide exhaustive lists of specific diseases and syndromes given any symptom, finding or test result. Often these lists contain too many unlikely diagnoses to be of much use, but they are valuable when common diagnoses have been excluded and unusual and unfamiliar ones must be considered. As you progress in your clinical training, you will learn typical differential diagnoses for most of the common conditions in medicine (e.g. chest pain, cough, abdominal pain in each quadrant, and other conditions).

Example: A reasonable differential diagnosis for chronic, nonproductive cough among non-smokers includes: asthma, gastroesophageal reflux, and post-nasal drip.

**Pertinent positive symptom or finding:** A symptom or finding is pertinent to specific hypothesis if it strengthens the case *for* that hypothesis. For example, pneumonia is one reasonable hypothesis that could explain cough. Night sweats is a pertinent positive symptom vis a vis that hypothesis and fever is a pertinent positive sign.

**Pertinent negative symptom or finding:** A symptom or finding is a pertinent negative when it's absence strengthens the case *against* a specific hypothesis. The absence of chest pain is a negative observation that argues against myocardial infarction as an hypothesis to explain a patient's acute shortness of breath.

**Problem List:** A problem list is a summarization tool used frequently by most physicians practicing in a wide variety of settings. There are as many variations of the basic problem list as there are different settings in which physicians practice. Primary care physicians may use one type of problem list to summarize a single encounter with a patient presenting with a few minor complaints and another type of problem list to maintain a comprehensive catalogue of all the medical and psychosocial information relevant to a patient's care. Another type of problem list is commonly used in the hospital setting where the listing of a general problem like "Fluids, electrolytes, and nutrition" for all patients serves as a reminder to check on these critical items everyday, even though none of these things may become an issue during a hospitalization.

A few common types of problem lists and some typical ways they are structures are shown below:

1. **Comprehensive problem list** (Often found at the front of a chart used in the ambulatory setting, or as an opening screen for an electronic medical record). It usually includes a list of all a patient's important medical, surgical and relevant psychosocial problems, past and present. The comprehensive problem list should include
  - Diagnoses of active medical conditions and important past medical conditions
  - All major surgeries
  - Important risk **factors** for future illness
  - Relevant psychosocial issues.
  
2. **Working problem list for an acute encounter:** This type of problem list may be limited to those problems that have been identified from a clinical problem analysis of the patient's chief complaint/s and the history, physical examination and testing that were done in response to the complaint/s. The problem or problems identified may be listed in several different ways depending on how the pertinent positive symptoms and findings were grouped and how far the examiner was able to go in reaching a specific diagnosis. Here are some examples of how problems may be listed:
  - A single symptom (e.g. cough), sign, or test result that is felt not to be related to any other symptoms, signs or test results and for which specific diagnosis has yet been proposed.
  - A group of symptoms, signs, and/or test results (e.g. cough, chest pain, hemoptysis, rales, and pulmonary infiltrate) that are felt likely to be related, but for which no specific diagnosis is proposed.
  - A diagnosis (e.g. pneumonia) (Remember there is a wide spectrum of types of diagnoses ranging from broad disease categories to specific diseases)
  - A risk factor relevant to any of the leading hypotheses put forward to explain the patient's presenting problem/s. (e.g. cardiac risk factors would be listed for a patient presenting with chest pain as a reminder of these important pertinent positives).
  - A relevant past medical diagnosis, chronic condition, or surgery.
  - A relevant psychosocial factor
  - Allergies and important adverse reactions to medication
  
3. **Hospital admission working problem list:** This may be similar to the working problem list for an acute encounter, but may include a more comprehensive list of chronic conditions, adverse reactions to medication and surgeries, as well as some "routine" problems that serve as reminders to check daily on key aspects of care (e.g. fluids, electrolytes, and nutrition). This list should be more comprehensive than a problem list for a single outpatient encounter, because new problems may emerge during a hospitalization that may require knowledge of chronic conditions or surgeries not likely relevant to a single outpatient encounter.

Problem lists for acute encounters and hospital admissions will often include a brief assessment of each important, active problem, which should include a differential diagnosis and an action plan related to that assessment which should include diagnostic and therapeutic measures.

You may be wondering how a problem list and a SOAP note are related. One way to organize the reporting of history and physical examination, especially in the outpatient setting, is to use a SOAP format for each problem that is identified. In this way, all relevant history and findings for one problem are listed under the heading of that problem along with an assessment (including a differential diagnosis) and the action plan. It is also acceptable to write up the entire history and physical examination relevant to an encounter in one place and then to list beneath that a problem list, which will then include only the name of the problem and an assessment and plan.

Here are some examples of these two approaches to writing up outpatient encounters:

**Option 1:**

Chief Complaint: Cough, fever and abdominal pain for four days

Problem 1: Cough and fever

S: Dry cough without SOB, chest pain, etc. History of asthma, on no medication. Otherwise cardiopulmonary ROS is negative.

O: Scattered wheezes, otherwise normal lung exam. Normal cardiac exam.

A: Probable mild exacerbation of asthma. Rule out pneumonia. Fever likely not related to cough.

P: Chest X-ray, Peak Flow, Albuterol inhaler.

Problem 2: Fever and abdominal pain

S: RLQ abdominal pain, anorexia. GI ROS otherwise negative.

O: Point tenderness in RLQ. Rebound and guarding.

A: Acute abdomen. Rule out appendicitis. Possible gastroenteritis.

P: Abdominal CT scan, surgery consult.

**Option 2:**

Chief Complaint: Cough, fever and abdominal pain for four days

(S) HPI: Dry cough without SOB, chest pain, etc. History of asthma, on no medication. RLQ abdominal pain, anorexia.

Cardiopulmonary and GI ROS negative.

(O): PE: Scattered wheezes, otherwise normal lung exam. Normal cardiac exam Point tenderness in RLQ. Rebound and guarding.

Problem 1: Cough and fever

A: Probable mild exacerbation of asthma. Rule out pneumonia. Fever likely not related to cough.

P: Chest X-ray, Peak Flow, Albuterol inhaler.

Problem 2: Fever and abdominal pain

A: Acute abdomen. Rule out appendicitis. Possible gastroenteritis.

P: Abdominal CT scan, surgery consult.