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The Problem-Oriented Approach to Clinical Medicine

1.1 The Role of Clinical Reasoning in Diagnosis Making

> In an ideal world, every patient would display unambiguous signs of disease conforming to classical textbook descriptions, and the clinician's pharmacy would be an assembly of rational and efficacious therapeutic agents that would collectively address all the diseases of the animal kingdom. Unfortunately, the ideal world is not the real world, and a series of limitations relating to all aspects of diagnosis and therapy make veterinary medicine (as with human medicine) "a science of uncertainty." Arriving at the most likely diagnosis, "best" treatment, and most informed prognosis is a higher-order skill. *(Ref. [1], p. 200)*

To be successful veterinarians, students must diagnose and treat their patients. To do so adequately and accurately, they must think like clinicians. They must consider, for every patient, the odds that disease "x" is most likely, and balance these odds against clinical unknowns and uncertainties [2, 3]. They must develop and fine-tune the skill of clinical reasoning.

Clinical reasoning refers to "the practitioner's ability to assess patient problems or needs and analyze data to accurately identify and frame problems within the context of the individual patient's environment" [4]. This skill allows clinicians to initiate, evaluate, and adapt case management to the patient as patient needs change and/or as diagnostic test results provide additional insight into the root of the patient's problem [4].

Clinical reasoning is thus intimately tied to critical thinking, and both are dynamic processes. They do not begin and end with diagnosis [5]. They evolve as external factors and internal inputs are considered. Internal inputs include prior experiences with the same set of clinical signs. These so-called "illness scripts" generate context as well as a working memory of which treatments have been historically effective at managing the presenting complaint [6, 7].

Over time, the experienced clinician develops a library of patterns to assist with clinical decision making [8]. Associations are made between new patient presentations and past events in such a way as to guide diagnostic approaches and therapeutic plans [1, 8]. Eventually, these associations become automatic as the clinician unconsciously draws from these reserves to approach and manage new cases [9].

To become effective at clinical reasoning, clinicians have to master critical thinking and develop the ability to acquire, define, and compare key pieces of patient data [10]. Probing questions that may assist with this process include [9, 11] the following:

- What do I ask to gather the information that I need from the history?
- Which findings from the history and physical examination are pertinent to case management?
- What additional data are needed to clarify, support, or refute these findings?
- How do I best obtain that additional data?
- What are the differential diagnoses?
- Which differential diagnosis is most likely for this patient?
- If the diagnosis is "x," then how will I proceed?
- If the diagnosis is not "x," then where do I go from here?

History taking begins the process by which clinicians gather data. Physical examination findings add to the collection of data and allow for further characterization of the data as being "normal" or "abnormal." Clinicians must be able to interpret data to form and test hypotheses about which diagnosis is most consistent with case presentation [10, 11].

Pattern recognition speeds this process for clinicians because, by virtue of their experience, they already have an established library of data against which to compare new findings. Even then, when faced with clinical cases that they have not experienced before, clinicians are

Common Clinical Presentations in Dogs and Cats, First Edition. Ryane E. Englar.

able to sift through their memory bank to draw upon similarities to past events. These links to the past trigger the clinician's recall of pathophysiology that is relevant to the current case [12].

Students lack this memory bank. They are slow to find patterns because there is much that they have yet to experience. As learners, they must overcome these gaps in knowledge and experience, and channel what they do know into viable approaches to patient care and solutions to patient problems. Mastering the possibilities and probabilities of disease, and applying these to the individual patient are major steps in the evolution of student to clinician.

The "preclinical/clinical divide" is a milestone in that professional journey [13]. As the student transitions from the classroom into the clinic and assumes the professional role of clinician, he starts to think like one. Yet, waiting until the clinical year to practice this skill may contribute to graduates who do not feel competent or confident to engage in clinical reasoning on their own [8]. It takes time to develop clinical reasoning as is the case with any other skill, and one clinical year of rotations may be insufficient [8].

In an effort to deliver "Day One Ready" graduates, accrediting bodies have established a set of core competencies that veterinary educators must infuse into the curriculum. Both the American Veterinary Medical Association (AVMA) and the Royal College of Veterinary Surgeons (RCVS) now consider clinical reasoning a core competency. Both expect graduates to be well versed in problem-solving skills so that they are primed for success in clinical practice [8, 14].

In response to demands by accrediting bodies, many veterinary educators are actively reshaping curricula to encourage critical thinking as early as the first year of veterinary college [15]. Educators have experimented with problem-based learning (PBL), self-reflection and experiential learning exercises, concept mapping, and integrative curricula [4, 16–22].

The most effective approach to teaching clinical reasoning in veterinary medicine is unclear [8, 14]. As veterinary educators, we just know that we need to do better. Simply exposing students to the clinic floor is not sufficient to develop clinical reasoning [8]. Learning to imitate mentors and learning to reason are not one and the same.

Students are often shielded from the responsibility of decision making in teaching hospitals. The intern, resident, or attending clinician makes case management decisions. This takes away the opportunity for students to make decisions on their own and learn from the consequences of each decision [14].

An added complication is that veterinary educators tend to encourage rote memorization. This often occurs at the expense of clinical reasoning. Teaching to the test and asking students to retain information without context proves challenging for students, who are easily overwhelmed by the vastness of medical knowledge and clinical theory [1].

Memorizing lists of differential diagnoses also encourages a backward approach to case management [1]. Students stamp what they know onto a clinical case and try to make it fit when, in fact, most patients stray from the classic textbook case [1].

If students do not know that a particular differential diagnosis exists, they are limited in terms of the resources that they turn to. For example, if gastric dilatation-volvulus (GDV) does not exist in their vocabulary, then how might students learn about it? Most reference guides outline content by diagnosis, and students do not know how to research a medical condition that is foreign to them.

It is true that students ultimately need to be able to make the diagnosis. They need to be able to diagnose GDV to manage the patient effectively. However, a student with no previous association with or knowledge of GDV is unlikely to come to that diagnosis on his own. On the other hand, a student who works forward from the presenting complaints, abdominal distension and nonproductive retching, may find greater success.

1.2 The Evolution of the Problem-Oriented Approach

The problem-oriented approach allows students to work their way through case presentations that may not be familiar to them. It provides a foundation for problem solving *now* that can translate into pattern recognition *later* [8].

Students who learn to recognize clinical signs and apply these to clinical algorithms actively build context into their library of cases that they are likely to experience in clinical practice [8, 23]. Context allows students to develop, structure, and apply knowledge methodically in a way that fits how cases will present to them. Cases will not present, for instance, as the diagnosis of persistent right fourth aortic arch (PRAA), but they will present for regurgitation.

Learning how to think through cases by considering each contributing problem, one at a time, facilitates decision making. It also models how to think like a clinician before one has acquired a functional library of illness scripts.

The problem-oriented approach is relatively new to clinical medicine. It was adopted by the veterinary teaching hospital at the University of Georgia in the early 1970s [24]. Most North American colleges of veterinary medicine have since adapted it for their use in teaching, as has the Royal Veterinary College (RVC) [24, 25].

Rather than jumping straight to diagnosis, which requires clinical experience and pattern recognition, the problem-oriented approach concentrates on clinical signs. These so-called "problems" reflect the patient's underlying disease and can be studied both in isolation and collectively to build a case for a particular disease process [24, 26].

Because this approach emphasizes patient problems, the clinician must devote time and resources to gathering information. This patient-specific information constitutes the database.

1.3 The Database

A minimum patient database includes a comprehensive history and physical examination [24]. For more information on history-taking, refer to Chapter 2. For additional guidance with the examination of canine or feline patients, consult the textbook *Performing the Small Animal Physical Examination* [27].

The goal of the database is to gather enough information to identify all patient problems [24]. Some of these problems may pertain to the presenting complaint.

Other problems may be incidental findings, meaning that they were unearthed by history taking or through the physical examination, but are unrelated to the presenting complaint. Incidental findings need to be addressed at some point. However, they may not be prioritized at that office visit if they are not urgent matters that must be tended to right away. For example, consider a patient that presents with a hemoabdomen and dyspnea after automobile trauma. On physical examination, this patient may also have aural discharge. Both hemoabdomen and aural discharge are problems for the patient. The former is the reason for presenting to the clinic, and the latter is incidental. The aural discharge should be evaluated to determine if there is underlying otitis externa. However, stabilizing the patient is more important during the patient's initial assessment than addressing the aural discharge. Therefore, the aural discharge must take a back seat to the hemoabdomen, which could result in patient fatality.

In addition to history and physical examination findings, patient databases may include other details [28]. Database contents often vary from practice to practice and between clinicians. Some databases include bloodwork, such as a complete blood count (CBC), chemistry panel, and urinalysis (UA). Others include diagnostic imaging, such as three-view thoracic radiographs or abdominal ultrasound.

Increasingly, there is a push in healthcare to tailor the database as well as diagnostic test recommendations to the patient rather than to pursue a universal database [29–32].

1.4 The Problem List

From the database, a collection of problems emerges. These accumulated problems form the basis of the problem list. The problem list is a collection of ailments, clinical signs, presenting complaints, or diagnostic findings that the clinician has identified [24].

Problems are listed with only as much detail as can be provided at the time of documentation [26]. For instance, a patient that presents for diarrhea will have *diarrhea* listed as a problem until that problem can be further refined. It would be inaccurate for the initial entry in the medical record to list *large bowel diarrhea* unless this degree of specificity is accurate. Doing so would cause the clinician to rule out causes of *small bowel diarrhea* prematurely, unless the patient's *large bowel diarrhea* truly has been confirmed.

The problem list is thus dynamic: it changes as the case evolves. Listed problems are often initially vague or poorly defined [33, 34]. As the work-up proceeds, clinicians update problems to their current level of understanding [26, 33, 34]. *Right hind limb lameness* may be refined to *right stifle pain and right cranial drawer* following orthopedic examination. Subsequent radiography may reveal additional problems, such as *right stifle* and *right tarsal osteoarthritis*.

This process of refining the problem list reflects the appropriate and methodical funneling of information toward a diagnosis. Refining the problem list as the case evolves also guards against tunnel vision. Consider a patient that presents for owner-witnessed "seizures." History taking reveals that these episodes may or may not be seizures and would be more appropriately labeled as collapse. A problem of *collapse* allows the clinician to consider seizures as well as cardiovascular events until diagnostic test results prove otherwise. This prevents the clinician from inappropriately ruling out syncope at the start of the work-up.

The same could be same of the "coughing" cat: is it really coughing or is it wheezing? Is it dyspneic or it is trying to bring up a hairball?

A broad problem list at the start of a work-up keeps options open. It allows the clinician to consider each option as being possible until there is sufficient evidence to suggest otherwise.

As clinicians acquire more information about each case through diagnostic investigation, problem lists grow. The discovery of one problem may unearth several more. Problems may be interrelated or they may be stand-alone. The burden falls upon the clinician to discover if, when, and how they intersect.

1.5 Prioritizing the Problem List

Patients often present with more than one problem. Not all problems are of equal concern to the client and clinician. The client may be most concerned about problem "x"; the clinician may be more concerned about problem "y." This disparity in perceived value demonstrates the importance of establishing priorities and communicating these to the client so that clinician and client are on the same page. In order to move forward with case management, both parties need to find common ground concerning the following questions:

- Which problem(s) need(s) to be addressed now?
- Which problem(s) can be addressed later?
- Which problem(s) should be addressed now, but have been tabled for later?
- When will tabled problems be reconsidered?

Prioritizing the problem list is an important aspect of case management [8, 23]. Patient outcomes rely upon the clinician being able to effectively distinguish problems that require immediate action from those that do not [8, 23].

Let us revisit the patient that presented on emergency with hemoabdomen and dyspnea. Physical examination reveals conjunctivitis and brittle nails in addition to aural discharge. In total, this patient has five problems. However, not all five carry equal value at the time of presentation. Whether the patient lives or dies depends upon whether or not the hemoabdomen and dyspnea can be medically or surgically managed and resolved. Thus, hemoabdomen and dyspnea become the patient's primary problems.

By contrast, the resolution of aural discharge, conjunctivitis, and brittle nails does not affect patient survival. Although aural discharge, conjunctivitis, and brittle nails appear on the problem list, they do not require immediate attention. Their presence on the problem list is a reminder that they can and will be addressed at a later point in time, when doing so is in the best interest of the patient.

To reflect this prioritization, the problem list is often written in order from most to least pressing concerns:

- Hemoabdomen
- Dyspnea
- Aural discharge
- Conjunctivitis
- Brittle nails

This reminds the novice to focus on what is most important first. Sometimes this organization is inherently obvious. Sometimes the case presentation makes it difficult to discern what the primary problem is and how best to address it.

Another organizational tool may assist novices as they gain additional clinical experience: the lumping of "like problems" together. Consider again the aforementioned case of the patient with hemoabdomen. Physical examination also reveals pallor, tachycardia, and thready femoral pulses. Packed cell volume (PCV) is well below the normal reference range. The evolving problem list may now read as follows:

- Hemoabdomen
- Pallor
- Anemia
- Tachycardia
- Thready pulses
- Dyspnea
- Aural discharge
- Conjunctivitis
- Brittle nails

This organization reflects a higher level of thinking and data processing. The clinician has moved beyond simply listing data. Instead, the clinician is making use of critical thinking to interpret the data and consider how the underlying pathophysiology may in fact link one or more problems to each other.

1.6 Moving Beyond the Problem List to Consider the Cause of Disease

Anyone can be trained to scan through a patient file, take a patient history, examine a patient, and list problems. However, knowing how to use the problem list is what makes a clinician successful at managing patient care. An experienced clinician moves beyond the basics of problem identification to consider the source(s) of the problem(s).

Problems may stem from local or systemic disease. For example, epistaxis could result from embedded foxtails in the nasal cavity or from ingested rodenticide that triggers coagulopathy. Retinal detachments could result from trauma sustained by one or both eyes, or from systemic hypertension. Coughing may be due to upper airway irritation or cardiac chamber enlargement secondary to cardiomyopathy that displaces the trachea. Lameness may be due to thermal burns on paw pads, or secondary to immune-mediated polyarthropathy.

For the novice, the possibilities may seem endless. Consider, for example, the problem of *weight loss*. Weight loss is a vague problem, of which there are many causes. Weight loss could stem from anorexia: a patient that is not consuming calories will lose body condition. But anorexia is not the only cause of weight loss in companion animals. What if the patient is eating, but is incapable of keeping food down? A vomiting patient may take in

sufficient calories, but lose them via emesis before they can be absorbed.

The gastrointestinal tract may seem the most obvious source of the problem, *weight loss*, but is it the only source? Weight loss may also result from disease outside of the gastrointestinal tract. Consider, for example, feline hyperthyroidism. In this case, endocrinopathy rather than gastrointestinal disease causes loss of body condition. Similarly, consider cachexia due to chronic kidney disease (CKD), congestive heart failure (CHF), or neoplasia. None of these conditions directly target the gastrointestinal tract, yet weight loss is a clinical sign that may be attributed to each.

Because the novice is still learning about pathology and pathophysiology, he may struggle to consider all possible causes or sources of disease. Considering these potential sources *broadly* may facilitate the novice's approach. Rather than deducing a list of differential diagnoses with which he may or may not be familiar, the novice may start with an outline of broad categories of disease that may apply to the patient. These broad categories have been integrated into acronyms for ease of recall by veterinary students and new graduates alike. Consider, for example, the acronyms of NITSCOMP DH [35] and DAMN-IT [26, 36, 37] (see Tables 1.1 and 1.2).

Note that there is overlap between the NITSCOMP DH and DAMN-IT schemes. Both acronyms include infectious disease as well as developmental and toxicity-induced disease. The categories for disease are simply worded differently, depending upon the acronym.

Neither acronym is perfect. Neither represents the "best" approach. Instead, both are diagnostic tools to keep clinicians from developing tunnel vision. They are reminders that every problem has a multitude of potential causes. These include causes that are *iatrogenic*, induced by either the examination or medical treatment, and causes that are *idiopathic*, that is, still unknown.

Not all categories of the acronym may apply to every patient. Additionally, some categories may be more likely than others, depending upon the patient's signalment and geographical zone of residence.

Consider how age may lead the clinician to prioritize one cause of the patient's problem over others. A congenital defect such as patent ductus arteriosus (PDA) is unlikely to be diagnosed in a 16-year-old Newfoundland dog whose primary problem is collapse. PDA typically causes heart failure and death at a young age [38]. This patient would not likely have survived to age 16 with an undiagnosed and untreated PDA.

Consider how geography may also influence a clinician's assessment of the patient's presenting complaint. Visceral leishmaniasis may be considered in a tropical region such as Brazil [39], but would be unlikely as a cause of lymphadenopathy and weight loss in a United-States-born dog that has never traveled outside of the state of Maryland.

The burden falls upon the clinician to assimilate and interpret the data in a way that makes the most sense in that it fits the clinical picture.

Table 1.1 The NITSCOMP DH acronym as a practical diagnostic aid.

First Initial	What the First Initial Stands for
N	Neoplasia
I	Infectious
T	Toxic
S	Structural
C	Congenital
O	Other
M	Metabolic
P	Parasitic
D	Diet
H	Husbandry

This acronym prevents students from making a premature diagnosis by encouraging them to consider all options.

Table 1.2 The DAMN-IT acronym is a second example of a practical diagnostic aid.

First Initial	What the First Initial Stands for
D	Degenerative
D	Developmental
A	Anomalous
A	Accident
A	Autoimmune
M	Metabolic
M	Mechanical
M	Mental
N	Nutritional
N	Neoplastic
I	Inflammatory
I	Infectious
I	Ischemic
I	Iatrogenic
I	Idiopathic
T	Traumatic
T	Toxic

It is a reminder that most problems on the problem list have more than one potential cause, and that all potential causes ought to be considered until they have been ruled out.

Much as the problem list is the starting point for considering the source of the problem, these acronyms provide a starting point for making patient-specific plans that take into account the probable diagnoses.

1.7 The Patient-Specific Plan

Although it is possible that the diagnosis is obvious without further investigation – for example, a urinary tract obstruction in a cat – the clinician most often has to formulate a patient-specific plan before making the diagnosis. Decisions for the patient must be made in spite of uncertainty, and potential benefits and risks to the patient must be considered [40–42]. Cost of care is weighed against the cost of benign neglect, and proceeding with case management requires buy-in from the client.

Ultimately, a tripartite plan is implemented by the clinician and includes [24]

- The diagnostic plan
- The therapeutic plan
- The plan for client education.

In the problem-oriented approach, there is a set of plans for each problem [24]. These plans may overlap into one master plan, particularly if there is overlap in the problems.

The diagnostic plan outlines the tests that the clinician has selected to get to the root of the problem [24]. For example, an appropriate diagnostic plan for acute vomiting in a two-month-old Golden Retriever puppy may include a CBC, chemistry panel, fecal analysis, a tabletop parvovirus antigen test, and abdominal radiographs.

All tests may be performed at once, or the tests may be performed sequentially. In the case of the latter, shared decision making between the clinician and the client dictates which test(s) will be performed first. In the example provided, consider that the client only wants to test for parvovirus. If that test is negative, then the client may proceed with additional diagnostic tests.

The diagnostic plan also tests clinical reasoning skills. The clinician must consider which tests are indicated and why, based upon the problem list for that particular patient, rather than testing for everything because every tool is available [24].

The therapeutic plan addresses specific care measures that the clinician will take, relative to the patient, in an attempt to diminish, if not resolve, the problem [24]. In the aforementioned example of the vomiting puppy, the therapeutic plan might include hospitalization for monitoring, placement of an intravenous catheter, and the administration of intravenous fluids and an injectable antiemetic.

The therapeutic plan also challenges the clinician to reason through which treatments may be initiated before diagnostic testing and which may need to wait until after diagnostic test results have been finalized [24]. For example, the administration of maropitant citrate to halt emesis is contraindicated in those patients with gastrointestinal obstruction [43]. Clinicians must rule out gastrointestinal obstruction first before this arm of the therapeutic plan can be initiated, for the safety of the patient.

The client education plan outlines any discussions with the pet owner relative to the patient's condition, apparent prognosis, and care options including, but not limited to, the patient's diagnostic and therapeutic plans [24]. This section challenges the clinician to document the exact nature of these conversations: what was actually discussed rather than what the clinician assumes the client knows. The clinical reasoning component here is deciding what needs to be said, when it needs to be said, and how it needs to be said.

Just as the problem list evolves over time as case management progresses, so, too, does the set of patient-specific plans. As results trickle in from diagnostic testing, the clinician must constantly pool, assess, and interpret data. At any given point in time, the clinician should consider

- What is the test result?
- What does this test result mean for this patient?
- What does it mean for the patient if my interpretation is wrong?
- Where do we go from here?

The clinician must ask a similar set of questions as the patient endures therapeutic management:

- Is the patient responding to therapy?
- If so, which therapy?
- How did the patient respond?
- Should we continue treatment as is?
- Should we modify treatment?
- If so, why and how?

As plans evolve, their reason for doing so should be clear. Case management is facilitated by having logical decision making outlined in the medical record, and recognizing that care should be adapted to the patient rather than the other way around.

1.8 How does the Problem-Oriented Approach "Fit" this Textbook?

Most textbooks are outlined by diagnosis. In order to research diagnostic and therapeutic plans for a given problem, students are required to know the diagnosis. This is an effective approach to learning when the

diagnosis is known, or when the learner has successfully developed the art of pattern recognition. Past experiences with similar cases trigger recall that leads to reasonably accurate diagnosis making even in the face of uncertainty.

However, students' lack of experience and exposure to clinical cases makes them particularly weak when it comes to pattern recognition. They are less likely to arrive at the correct diagnosis [8, 26]. They may or may not stumble upon the condition of interest; they may or may not be able to research the topic from which their patient would directly benefit.

Students are, however, more reliably able to identify clinical signs or presenting complaints. These problems provide them with a foundation to embark upon a journey of critical reasoning. They allow students to work though the thought process, as would a clinician. In this way, students learn a problem-oriented approach that is more likely to lead them to the answer.

Because of its approach, this textbook is not intended to be comprehensive. Those details are best left up to a diagnosis-based resource.

What this textbook aims to provide is a new perspective on approaching medicine based upon the presenting complaint. The hope is that over time, the process will become automatic, and students may begin to develop subconscious rules and patterns that fit various clinical situations. As students evolve into clinicians, their ability to work through this process facilitates diagnosis making. Learning how to process data using this approach should make even the most complex cases approachable, one problem at a time.

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