

# Enhancing Clinical Reasoning Education: Implementing Case Conferences with Semantic Qualifiers and the Dual-Process Theory

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**Abstract:** Clinical reasoning skills are crucial for physicians. In clinical reasoning conferences using real cases, medical students, residents, and senior residents can follow experts' clinical reasoning processes. However, supervisors may struggle to clearly articulate their clinical reasoning process. It is necessary to demonstrate this process concretely and systematically for educational purposes. This study introduces the method of clinical reasoning case conferences using semantic qualifiers and the dual-process theory designed for outpatient cases to improve clinical reasoning education methods for beginners. In these conferences, participants assume the roles of a moderator, learner, presenter, and commentator. The presenter sets the first semantic qualifier from the chief complaint and pre-examination information, presents the present illness history, and then sets the second semantic qualifier. After the learners propose a snap diagnosis, the presenter provides additional information, and the learners develop a comprehensive differential diagnosis. Finally, the presenter shares the examination results, and the group discusses the results, determines the final diagnosis, and decides the future diagnostic strategy. This method helps expert physicians articulate their clinical reasoning process, aiding in the education of learners at all levels and enhancing supervisors' metacognition of their medical practice.

**Keywords:** clinical reasoning, semantic qualifier, dual process theory, case conference, education

## Introduction

Clinical reasoning skills are crucial foundational knowledge for physicians.<sup>1</sup> However, in Japan, improving clinical reasoning skills depends on individual motivation and experience, with limited opportunities for systematic education after graduation.<sup>2</sup> Clinical reasoning conferences using actual cases offer a method for educating beginners, such as medical students and residents to achieve this, by allowing them to follow experts' reasoning processes. In recent years, online education has advanced significantly, making comparable levels of satisfaction and performance achievable through face-to-face and online education. Clinical reasoning conferences are one of the educational methods that can be conducted in person or online.<sup>3,4</sup>

The hypothetico-deductive method, dual-process theory (DPT), and semantic qualifiers (SQs) are established clinical reasoning methods.<sup>5</sup> Other methods for differential diagnoses exist, such as VINDICATE+P, which consider pathology and acronyms,<sup>6</sup> and an anatomical approach, which considers pathology and anatomy.<sup>7</sup> However, in clinical practice or general conferences with un-fixed formats, the thought processes of presenters and supervisors may not be clearly articulated, making it difficult for beginners to understand them. Despite the recognition of various methods, such as DPT and SQ settings, few opportunities exist to use each method clearly during actual conferences, and no clear policy has been established for conferences aimed at acquiring clinical reasoning skills. Moreover, supervisors may know these

strategies but struggle to practice or clearly articulate them.<sup>8</sup> Therefore, it is necessary to systematically show how information from pre-examination forms, referral letters, medical history, and physical examinations influence subsequent actions, leading to the differential diagnosis. This study aims to establish an effective method of clinical reasoning education for beginners by introducing the clinical reasoning case conference we developed for outpatients and discussing effective education methods supported by the literature.

## Conference Implementation Method

### Conference Overview and Roles

The following is an outline of our developed clinical reasoning education conference method. The roles include the following:

- Moderator: Uses a whiteboard (Figure 1) to organize information and lead discussions
- Learners: Approximately six (medical students, residents, and senior residents)
- Presenter: A resident, senior resident, or supervisor responsible for outpatient care that day (learners can also be presenters)
- Instructor: A supervising physician who selects a suitable case
- Commentators: One to five supervising physicians

### Set the 1st SQ

The procedure is outlined in Table 1. Initially, the presenter sets the 1st SQ based on information such as the chief complaint, pre-examination form, and referral letter. If time permits and learners are sufficiently advanced, they may set the 1st SQ. If the 1st SQ is not appropriate, the instructor and commentators provide guidance and correction.

### Set the 2nd SQ and Propose a Snap Diagnosis

The presenter then discusses the current medical history and sets the 2nd SQ. The commentator explains the newly added information and how it affected the SQ, or if there was no meaningful information and the SQ remained unchanged. Each learner then proposes a snap diagnosis. In System 1, beginner learners often make more significant errors owing to lack of experience. Hence, the instructor and commentators provide explanations to fill in gaps. System 1's accuracy increases

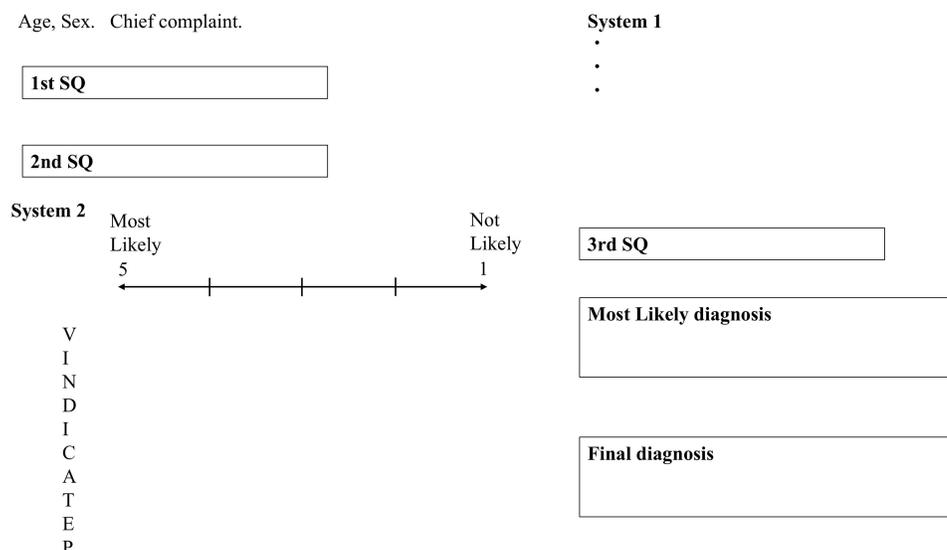


Figure 1 Examples of whiteboard descriptors.

**Table 1** Clinical Reasoning Education Conference Procedure

	Process	Details
1	Set the 1st SQ	The presenter sets the 1st SQ based on brief information, such as the chief complaint and pre-examination form.
2	Brush up on the 1st SQ	All participants discuss whether the 1st SQ is appropriate.
3	Present the current medical history	The presenter shares the current medical history.
4	Set the 2nd SQ	The presenter sets the 2nd SQ based on the current medical history.
5	Review the 2nd SQ	The commentator evaluates and explains whether the 2nd SQ is appropriate.
6	Propose a snap diagnosis (System 1)	The learners, instructor, and commentators propose a snap diagnosis in System 1 based on the 2nd SQ.
7	Review System 1	The commentators review and explain any inconsistencies or missing information on the differential diseases listed in System 1.
8	Present additional information	The presenter provides additional information, such as patient, family, and medication histories.
9	Propose differential diagnosis (System 2)	Based on the 2nd SQ and the patient's symptoms, all participants discuss differential diagnoses using VINDICATE+P or an anatomical approach. The instructor categorizes each diagnosis into five stages, from 1 (not likely) to 5 (most likely).
10	Confirm the most likely diagnosis (System 2)	Participants confirm the most likely diagnosis, which is written on the far-left side of the System 2-list on the whiteboard. The instructor discusses critical physical findings with the learners.
11	Present the physical findings	The presenter shares the physical findings.
12	Set the 3rd SQ	The presenter sets the 3rd SQ based on the physical findings.
13	Review the 3rd SQ	The commentators explain how the SQ changed owing to the physical examination.
14	Determine the most likely diagnosis	The presenter determines the most likely diagnosis based on the information gathered.
15	Set up an examination plan	The presenter sets an examination plan, and the commentators provide additional input.
16	Present the test results	All participants discuss the test results.
17	Determine the final diagnosis	The final diagnosis and the future diagnostic strategy are decided.

**Abbreviation:** SQ, semantic qualifier.

with expertise, making it unsuitable for beginners. However, discussing snap diagnoses helps learners understand the manner in which experts develop clinical reasoning using only limited information.

## Propose Differential Diagnosis

The presenter shares additional information such as patient, family, and medication histories; guided by the instructor, the learners implement System 2. The instructor provides support considering the learners' zone of proximal development tailored to their clinical reasoning ability.<sup>9</sup> Using the 2nd SQ and the patient's symptoms, learners list the differential diagnoses using VINDICATE+P or an anatomical approach. These diagnoses are ranked from 1 (not likely) to 5 (most likely). With input from the learners and commentators, the instructor determines the disease likelihood and makes necessary corrections. If the learner's differential diagnosis is insufficient, the instructor and commentators will add it. The final diagnosis is confirmed and listed on the left side of the System-2 list on the whiteboard. The instructor then discusses critical physical findings with the learners.

## Set the 3rd SQ

The presenter shows the physical findings and sets the 3rd SQ based on the results. The commentators explain the change in SQ following the physical examination. Subsequently, the presenter determines the most likely diagnosis and sets up an examination plan, which is supplemented by the commentator. The presenter then shares the test results for group discussion. The final diagnosis is determined, and future diagnostic strategies are decided.

## Discussion

The clinical reasoning conference we developed uses SQs and DPT, which are common clinical reasoning methods. By repeatedly setting SQs for each step, articulating the physician's clinical reasoning and thought process is possible. This conference also benefits supervisors, who unconsciously practice clinical reasoning without verbalization<sup>8</sup> to verbalize and visualize their own processes. This also enables metacognition in their clinical practice. Additionally, it benefits both beginners and residents by allowing them to understand expert perspectives and processes.

In each physician's outpatient practice, repeatedly setting SQs and using DPT highlights the importance of conducting histories and performing physical exams to gather essential information. Clinical reasoning involves information gathering, hypothesis generation, problem representation formation, differential diagnosis generation, selection of a working diagnosis, and provision of diagnostic justification.<sup>10</sup> This conference emphasizes hypothesis generation, problem representation formation, and differential diagnosis generation.

The presenter sets the SQ for the conference based on the information gathered. The SQ must be objective and clear to all participants.<sup>11</sup> For example, determining whether an onset is acute requires thorough understanding and clarity on the patient's medical histories, prioritizing specific information for an accurate hypothesis, and considering its validity.<sup>11</sup> Our conference method sets SQs at the following three points to clearly articulate the physician's thought process: when first receiving information (1st SQ), when listening to the patient's medical history (2nd SQ), and after completing physical examinations (3rd SQ). Writing these steps on a whiteboard and discussing them helps participants understand the evolving thought process. Considering that improving SQ skills is difficult through self-study alone, verbalizing clinical cases, sharing experiences, and conducting discussions are essential.

Our conference method uses the DPT to generate differential diagnoses. DPT is regarded highly by clinical reasoning educators and is a fundamental method in the field.<sup>8,12</sup> It combines intuitive and analytical processes, making it accessible for beginners and suitable for experienced physicians.<sup>13</sup> While both processes are challenging for beginners, practicing them is essential for accurate diagnosis. Our method thoroughly lists differential diseases for a single SQ using an anatomical approach or VINDICATE+P to enhance beginners' understanding and information retrieval skills. By categorizing the listed diseases into five stages (from not likely to most likely) with senior physicians, participants learn to disregard low-probability diseases and focus on quickly identifying high-probability diseases using the intuitive process.

## Limitation

This method has several limitations. First, it includes cases where the patient has not been diagnosed yet because another outpatient is targeted. In addition, some cases and symptoms are unsuitable for the conference format, and experienced physicians do not have sufficient time to engage to such an extensive degree. Considering that this method targets outpatients in the general medicine department, its application and effectiveness in educational settings within other departments may be limited. Additionally, it may be challenging to implement this method in environments where educational resources, such as personnel, are lacking. In such cases, this method can be viably implemented through online education. Furthermore, as the effectiveness of this method is yet to be validated, further research is required to verify its efficacy.

While diagnostic accuracy cannot be guaranteed, the conference method promotes an understanding of the clinical reasoning process in outpatient clinics and helps practitioners plan future diagnostic and treatment management strategies.

The best cases for this conference method are those with clear SQ changes at each stage (eg, medical history and physical examination) that can be visualized and contribute significantly to the diagnosis. Cases with multiple differential

diseases, specific medical histories, and physical findings are preferable. Conversely, cases relying solely on blood tests or imaging for diagnosis are unsuitable.

## Conclusion

Our clinical reasoning conference for beginners uses a simple method that repeatedly sets SQs and utilizes DPT to help visualize and clarify experts' thought processes. It also facilitates supervisors' metacognition of their own practice. Further research is needed to verify its educational effects.

## Abbreviations

DPT, dual-process theory; SQ, semantic qualifier.

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## Author Contributions

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