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### Physical Therapy Students' Application of a Clinical Decision-Making Model

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Jean Wessel, BScPT, MHSc, PhD<sup>1</sup> Renee Williams, Dip.P&OT, MHSc, MSc, PhD<sup>2</sup>  
Beverley Cole, BScPT, MSc, MBA<sup>3</sup>

1. Professor, McMaster University, School of Rehabilitation Science
2. Professor, McMaster University, School of Rehabilitation Science
3. Assistant Professor, McMaster University, School of Rehabilitation Science

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#### Abstract

**Purpose:** Most educational programs in the health sciences present their students with a clinical decision-making model (CDMM) to help them define and treat client problems with a client-centered approach. However, little is known about how well students apply such a model in a clinical setting. The purpose of this study was to determine whether physical therapy students used a CDMM to make clinical decisions, and how well they used it. **Method:** Fifty-four physical therapy students in their first full-time clinical placement were asked to write up one of their client cases explaining how they made their clinical decisions and evaluating the success of these decisions. Three faculty members used a standardized form to assess each student's use of various components of the CDMM. **Results:** Students were generally better at following the CDMM for obtaining information (history and assessment) and determining a diagnosis, than they were for planning goals and methods of treatment. Most students emphasized impairment rather than activity or participation, and did not consider the client's specific concerns. Although few students defined measurable outcomes for their clients, they still felt that their decisions were well founded and that the clients got better. **Conclusions:** Physical therapy students in their first major clinical placement believe that they are using the CDMM "automatically" and are making appropriate clinical decisions for their clients. However, students need assistance to effectively use all the steps in the CDMM to design client-centered, outcome-oriented treatment.

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#### Background

Clinical decision-making is a skill that has been studied in health professionals. It is known that experts use a different process than novices.<sup>1,2</sup> Experts recognize patterns or "clinical scripts" and then perform assessments to provide further evidence to support their hypotheses. This is called forward reasoning, and requires experience in the clinical area. When experts are confronted with an unfamiliar situation/condition, they tend to follow a reasoning process closer to that of the novice. This process is often called hypothetico-deductive or backward reasoning, and is frequently represented by models that start with initial cues (client complaint) and move on to diagnosis, treatment planning and reassessment.<sup>3</sup> On the other hand, Jensen et al<sup>4</sup> found little evidence of the use of the hypothetico-

deductive process in expert physical therapists in the fields of geriatrics, neurology, orthopedics, and pediatrics. For these experts, clinical reasoning was a collaborative process with the client, and also involved the therapists' "reflection-in-action" (term coined by Schön<sup>5</sup> to differentiate one's reflecting *while* experiencing the event from reflecting *after* the event [reflection-on-action]).

Recently, Edwards et al<sup>6</sup> developed the decision-making process well beyond the hypothetico-deductive approach. They discussed how therapists used "narrative" reasoning to understand the unique experience of the client. Rather than collecting data to clarify a hypothesis or find "truth," the therapist and client discuss and come to a consensus on the meaning of the

situation/experience. This can be referred to as “communicative” learning. They used three conceptual frameworks in their study to analyze qualitative data on therapists’ reasoning. These included: 1) clinical reasoning strategies, 2) the use of cues from clients to combine different reasoning strategies outlined in 1, and 3) debate to reconcile contradictions.

In the physical therapy literature, authors have presented methods/courses to teach clinical reasoning. Most follow the hypothetico-deductive process – students use a model as a guide, and questioning by faculty and fellow students helps the students make decisions at various steps in the process.<sup>7,8</sup> The process is not linear as the models usually suggest, but requires the students to go back and forth between stages. For example, students may develop hypotheses about diagnosis when they are interviewing the client (or acquiring initial information on a paper case), and plan the assessment accordingly. However, if the findings from the assessment do not confirm their initial suspicions, the students must go back and generate some new hypotheses and decide on some additional assessments. Some students may also collect most of their data (history and examination) before generating diagnostic hypotheses and potential treatment.

Carr et al<sup>9</sup> mentioned five aspects of learning clinical reasoning in physical therapy academic programs: 1) cognitive skills, 2) knowledge base, 3) metacognition (reflection) and self-evaluation, 4) interpersonal and communication skills, and 5) other skills (e.g., manual therapy). They go on to suggest some ways that these skills can be trained/enhanced. For example, undergraduate students can work in small groups to interview a client, generate and test hypotheses, determine learning needs, and reflect on their decisions. Therapists receiving specialized postgraduate training might keep a diary of clinical patterns/scripts. Algorithms have also been devised to help students make decisions.<sup>10</sup>

The purpose of this study was to determine how physical therapy students in their first clinical placement made decisions about diagnosis, treatment and outcome, and whether they used a model to guide their decision-making.

### Methods

The present study was part of a larger project examining critical thinking in physical therapy students. A guided reflection exercise was developed as one of the interventions to promote students’ critical thinking in the clinical environment. This exercise provided an opportunity to examine how students thought through the assessment and treatment planning of a specific client.

All 54 students (34 females, 20 males) completing their first clinical placement in the entry-level Master’s

physical therapy program at McMaster University participated in the study. Their mean age at entry to the program was  $25.6 \pm 3.4$  years. The primary undergraduate degrees of the students were kinesiology (n=20), science (n=22), arts (n=10), health science (n=2). Three students had additional undergraduate degrees in education (n=2) or kinesiology (n=1), and another two had MSc degrees. The cutoff grade point average for entry into the program was 3.62 out of 4. The study was approved by the university’s Research Ethics Board, and students provided consent for the use of their assignments in this study.

### Program

The physical therapy program at McMaster University is 24 months in duration and follows a completely integrated, problem-based curriculum. All learning is centered on health-care problems. Self-directed learning and evidence-based practice are key values. The program consists of 6 units (semesters), each of which has an academic and a clinical component. There are three courses in each academic component: problem-based tutorials (5 hours/week), clinical skills laboratories (5-7 hours/week) and professional issues or evidence-based practice (2.5 hours/week).

This study took place during the 6-week clinical component that followed the 8-week academic portion of Unit 2. In both Units 1 and 2, the students studied musculoskeletal conditions, and the basic and applied information required to assess and treat individuals with these conditions. Although the students had completed a total of seven “introductory” days in clinical settings after Unit 1, the clinical component of Unit 2 was considered their first, full-time placement. The students completed the assignment for this study (see next subsection) in the first 3 weeks of their clinical placement.

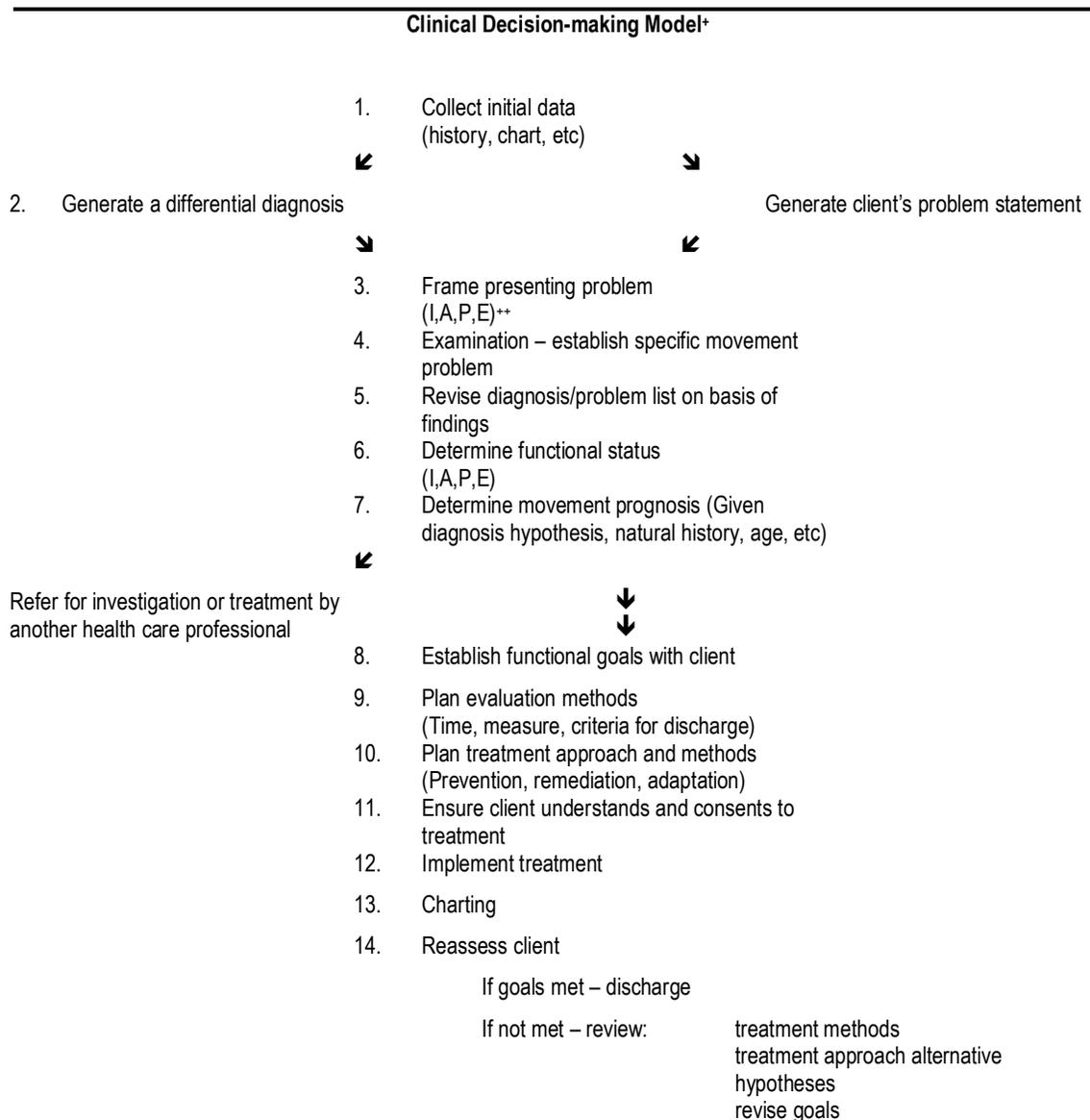
Problem-based learning is not the same as problem-solving. Nevertheless, there are several aspects of the problem-based curriculum of the McMaster program that are similar to the strategies that have been used in clinical reasoning courses for physical therapy.<sup>7</sup> In the problem-based tutorials, students are presented with cases and required to identify their learning needs. They must explain information they bring to the group, and justify their interpretation of the diagnosis, prognosis, and choices for assessment, treatment, and outcomes. Additional techniques such as concept mapping and problem write-ups are used in the courses to encourage greater understanding, integration and application of information.<sup>11</sup>

In Unit 1, the students were introduced to a clinical decision-making model (CDMM) (Figure 1) based on the hypothesis-oriented algorithm proposed by Rothstein and Echtertnacs.<sup>3</sup> Although based on a hypothetico-deductive process, this CDMM goes beyond diagnosis to include treatment planning, implementation, and

evaluation, and further decisions on the treatment results. In addition, the model considers the components of health as defined by the World Health Organization.<sup>12</sup> The students were encouraged to use the CDMM in their

tutorial sessions in both Unit 1 and Unit 2. The extent to which it was used in the individual tutorial groups varied, however, because of group and tutor differences.

**Figure 1. Clinical Decision-making Model**



\* Adapted from: Rothstein and Echtermach<sup>3</sup>

\*\* I,A,P,E – reminder to student to consider impairment (I), activity or disability (A), participation (P) and environment (E)<sup>12</sup>

### Assignment

Students were asked to write up one case from their Unit 2 clinical placement. They were to briefly describe the client's condition, explain how they made their clinical decisions, evaluate the success of these decisions and comment on the usefulness of the CDMM in their

decision-making. The specific instructions are provided in Figure 2. Students did not receive a mark for the assignment, but their clinical placement was considered incomplete until the assignment had been submitted to the Academic Coordinator of Clinical Education (ACCE).

Although outlining of treatment goals was not indicated as a specific task in the assignment, the students in the program are very familiar with specific, time-dependent, measurable goals. They also study outcome measures that are reliable and valid for measuring the desired

change. An example of a goal that students might outline for a tutorial case is: "in two weeks, the client will have a reduction in low back pain by 3 cm as measured on a 10 cm visual analogue scale."

**Figure 2. Instructions to Students for Guided Reflection Exercise.**

1. Select and describe one client case. Include just enough information so that the reader will understand the answer to the following questions.
2. How did you:
  - a) go about identifying the client's problem(s)?
  - b) decide on the treatment program?
  - c) evaluate whether you identified the correct problem(s) and chose the most appropriate treatment(s)?
3. Reflect on the effectiveness of your problem identification and treatment. Consider what you learned from the case, how it relates to your prior knowledge, any new understanding you have gained and how this situation might affect what you do in the future.
4. Now consider the usefulness of doing the problem write up.
  - a) What did you learn from doing the write up?
  - b) Would you use this write up process in the future? Why or why not?
  - c) Was the clinical decision-making model helpful in making your clinical decisions? Why or why not?

#### **Evaluators**

Three faculty members in the physical therapy program evaluated the assignments as outlined in Figure 3. All three faculty members had been involved in problem-based tutorials, teaching clinical skills, and organizing components of the program. One faculty member was the ACCE, and the other two were involved as tutors in Unit 1 or 2. They were to determine if the students described the case adequately to understand it and whether they used the CDMM or other logical means to decide on assessment and treatment options. As can be seen from Figure 3, the evaluators determined the process and information used by the students to make their decisions and conclusions, and then summarized the students' opinion of the assignment and use of the

CDMM. The ratings of the evaluators were examined for agreement. An item was considered reliable if all three evaluators agreed on the rating at least 75% of the time. When the agreement was less than this, the criteria for the ratings were reviewed, and the item scored again by each individual. This procedure resulted in all but 5 of the 22 items having at least 75 % agreement. These 5 items (2, 3, 4, 8, 11) involved at least 3-4 rating levels and a judgment as to the quality of a response. The ratings of these items were not used in the results, but the comments of the evaluators were summarized (see Figure 4). In addition, the rating of the case description was reliable because there was little variation between students. Details on all the items and their criteria are listed in an appendix.

**Figure 3. Form for Evaluation of Students' Guided Reflection Exercise**

ID # \_\_\_\_\_ Evaluator \_\_\_\_\_

1. Was the description adequate to understand the case/problem?	yes	partially	no
2. Did the student use the CDMM?	yes	partially	no
3. How well?	poor	fair	well
4. Did the decisions/procedures regarding the problem identification follow logically from previous steps?	yes	partially	no
5. What was treatment based on?			
evidence (efficacy/biological, etc)	yes	no	
client's clinical picture	yes	no	
diagnosis (routine for condition)	yes	no	
client's concerns (client-centered)	yes	no	
preceptor/therapist experience	yes	no	
6. Were goals of treatment stated?	yes	no	
specific (e.g. joint, movement)	yes	no	
outcome instrument	yes	no	
change required for improvement/success	yes	no	
Time	yes	no	
7. Were conclusions re: treatment efficacy based on:			
goals/specific outcomes	yes	no	
observation	yes	no	
preceptor OK	yes	no	
other _____	yes	no	
8. Did decisions/procedures regarding treatment follow from evidence/logic from the previous step(s)?	yes	partially	no
9. Did the student find the guided reflection exercise useful? Why or why not?	yes	no	
10. Did the student find the CDMM useful? Why or why not?	yes	no	
11. Quality of reflection/critical thinking?	poor	fair	good    outstanding
12. Comments and student reflections.			

**Results**

The results are presented as evaluators' perceptions followed by students' perceptions of the clinical decision-making process. Tables 1 and 3 indicate how students made their decisions about treatment and its effectiveness, and Table 2 indicates the percentage of students using goals, and using appropriate components of a measurable goal. Figure 4 summarizes common ways students made their decisions as related to the CDMM. Many students indicated that they used the CDMM automatically and it was not necessary to formally go through the process. However, in reviewing their case write-ups, the evaluators found that major

portions of the CDMM were omitted or used very poorly.

The majority of students felt the guided reflection exercise (74%) and the CDMM (76%) were useful, but many qualified these statements. Some students indicated that they used the CDMM automatically and didn't formally go through it. Others felt the assignment was very time consuming. On the positive side, students noted that the model helped to ensure that "nothing was forgotten." Others thought the exercise helped them really think about what they were doing and whether it was appropriate.

**Table 1. Basis of Treatment as Outlined by Students**

Treatment based on:	Percentage of students
Evidence from the literature	43
Clinical picture	87
Diagnosis	54
Client's concerns	46
Preceptor	33

**Table 2. Students' Use of Goals and Components of Measurable Goals**

	Percentage of students
Stated goal(s)	57
<b>Components used</b>	
Specific	46
Measurable outcome	26
Expected change	20
Time frame for change	26

**Table 3. Basis of students' conclusions about the effectiveness of treatment**

	Percentage of students
Discussed evaluation of efficacy	69
<b>Conclusions based on:</b>	
Outcome associated with goal	19
Observation	52
Preceptor's okay	7
Other	13

**Figure 4. Summary of Students' Use of the Clinical Decision-making Model by Steps****Steps 1-3**

- students described data collection (history, chart, etc) well
- students did not always have more than one idea for differential diagnosis

**Steps 4-6**

- students usually described physical examination and findings well
- students usually determined a diagnosis
- students were upset if they could not diagnose (put a label on) – they did not consider functional difficulty or a problem list as a diagnosis
- students did not always use physical findings well to reconsider diagnosis - that is they made the findings fit their initial diagnosis rather than considering the findings that didn't fit with their diagnosis
- some students did a good job of listing problems using IAPE; others emphasized impairment

**Steps 7-9 (see Table 2 for percentage of students)**

- students did not clearly define goals of treatment - some did not indicate any goals of treatment, some listed general rather than specific goals (e.g. increase strength)
- students did not use specific components of goals well
- students did not use outcome measures well to determine success of treatment

**Steps 10-12**

- students described treatment that was probably based on diagnosis rather than specific goals (e.g., a person with patellofemoral pain receives quadriceps strengthening, even though the student has not indicated that these muscles are weak, and has not indicated strengthening as a goal/outcome)
- students rarely referred to prevention, remediation or adaptation - most treatments were focused on reversing impairment
- several students commented on obtaining consent from client

**Steps 13-14**

- students noted that their clients improved, but were not specific about outcomes
- students felt they were successful in their decision-making because the clients improved
- students rarely referred to natural history when evaluating outcome

## Discussion

The results of this study suggested that physical therapy students at McMaster University did not use a clinical decision-making model effectively in their first major clinical placement. Although the assessment and diagnosis components of the model were followed, many students did not define measurable goals for their clients and thus were not specific about the desired outcome(s). Less than one-half of the students based decisions on clients' specific concerns. However, students felt they made good decisions and many felt they used the CDMM almost automatically.

The literature on clinical decision-making suggests that physical therapy students and novice clinicians use the hypothetico-deductive method of arriving at clinical decisions. This is a backward reasoning strategy where the clinician/student goes through a series of logical steps to come up with a differential diagnosis and a treatment plan. This method of reasoning has been used as a framework when teaching clinical reasoning to physical therapy students.<sup>7,8</sup> The CDMM used in this study was based on the hypothetico-deductive framework and had been utilized by the students in the academic component of their program. Nevertheless, students did not fully apply the model in the clinical setting.

The students' concern about a diagnosis and/or clinical signs and symptoms was quite different from the focus of expert clinicians who consider the diagnosis but regard functional problems as more central.<sup>4</sup> This difference seems quite reasonable, considering the students have limited experience, and therefore need a "diagnosis" or specific impairments to plan their treatment. However, almost half the students were at least beginning to consider some unique aspect of their client, such as age, intolerance to ice, and ability/inability to follow instructions.

Although the "impairment" focus of the students in this study was likely due to their inexperience, another reason could be the musculoskeletal/orthopedic placements they were in. Jensen et al<sup>4</sup> noted that physical therapy experts in orthopedics had a specific focus on the movement problem and on teaching clients to manage this problem. Experts in neurology, geriatrics and pediatrics put more emphasis on the psychological, social and psychomotor status of the client.

Of surprise to the investigators was the students' poor use of specific goals to guide treatment and evaluate its efficacy. Students this early in their program would not be expected to skillfully negotiate goals with their client. However, the education program emphasizes the use of valid outcome measures to evaluate treatment effectiveness. Students are expected to set goals in terms of the amount of change in an outcome that would be considered clinically important. Even if students failed

to set specific goals initially, it was hoped that some would realize their omission when they reviewed the effectiveness of their decisions.

The process of decision-making by the students demonstrated some common errors described by Watts:<sup>13</sup>

- 1) purpose of evaluation or treatment not clear – e.g., providing a strengthening program when there was no indication that strength was reduced
- 2) narrow – students only articulated one or two hypotheses, and did not indicate that they considered other methods of treatment
- 3) rigid – some students indicated that the CDMM was not as much use when there were standard protocols to follow, for example after surgery
- 4) wasteful – students appeared to perform tests that they did not really use in their consideration of the diagnosis and treatment
- 5) insensitive – although students are generally seen as kind and considerate by their clients, less than a half used client concerns in their decision-making
- 6) mystery – it was not always clear from the students' write-ups how they had made their decisions.

Although we were able to describe errors or omissions in the decision-making process of the students, the present study could not determine the influence of the clinical preceptor on this process. Some students mentioned discussing treatment with their preceptors, but it is impossible to know whether the preceptors facilitated the students' analysis. Watts<sup>13</sup> provided some questioning strategies and decision algorithms to help students with their decision-making. She suggested that teachers ask questions to understand the students' thinking and to push them to consider alternative diagnoses and treatments. She also suggested "what if" questions to help students consider the possible consequences of their decisions or how to proceed if a test was positive or negative. The development of a decision-making tree might assist the student in considering and comparing these alternatives. Subsequent research could examine the influence of some of these preceptor actions on the way students make decisions.

There are some limitations to this study. We used only student report. It is possible that students may have used some of the preferred strategies and steps of the CDMM but failed to report them. We also relied on evaluators' interpretations of the case report, because there was no follow up discussion with the students. However, there were three different evaluators, and their agreement was good on all items except as previously mentioned. There was no preceptor input to verify the student's description

and interpretation of the case.

One other confounder was an additional assignment that the students were asked to do while in their clinical placement. It involved describing the evidence (from the literature) that they used to support their clinical decisions. The students were asked to do the guided reflection relatively early in their placement to avoid contamination from this second project. If the second project influenced the students' responses, it would likely have increased their use of evidence to support their decisions. Thus the 43% of students referring to evidence in this study could be a slightly high estimate of students' usual behavior.

It should be noted, that the students in this study were in their first full-time clinical placement, and it would be expected that the results would be different with students in subsequent placements. Students at this time in their training had reasonable knowledge of body structure and function, musculoskeletal conditions, and some specific outcome measures, but little practice at integrating the knowledge and applying it to clients. Senior students would likely have a more client-centered approach, and be better able to reflect on the effectiveness of their interventions.<sup>17</sup> However, it is still not known how senior and junior students would compare in their formal use of a CDMM.<sup>14-16</sup>

### Recommendations

The assignment was very useful in revealing to academic faculty the difficulties students were having in

using the CDMM to help them make appropriate clinical decisions. Some students also used the assignment to help them identify omissions in their assessment, treatment or reasoning. However, most students felt they had made appropriate decisions even though they were not able to provide evidence to support their conclusions. It would seem necessary, then, to follow up on this assignment with feedback from the clinical or academic instructor. The instructors could discuss with the students their reasons for decisions, and help them consider additional information and perspectives. We know from student reflective journals that many clinical instructors assist students with the clinical reasoning process.<sup>18</sup> Therefore, it would be useful for clinical instructors to realize how students are thinking at this level, and be given some guidance on how to help the students with their clinical reasoning. To determine if students change the way they make decisions, the assignment used in this study could be repeated in subsequent clinical placements.

### Conclusion

The guided-reflection assignment used in this study was useful in describing the way students make clinical decisions. Physical therapy students in their first major clinical placement believe that they are using the CDMM "automatically" and are making appropriate clinical decisions for their clients. However, they need further assistance with designing client-centered, outcome-oriented treatment.

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**Appendix. Criteria for Evaluation of Students' Guided Reflection Exercise**

<p>1. Was the description adequate to understand the case/problem? Most descriptions were adequate for the exercise although students frequently missed presenting age and work/recreation of client, even when this was relevant to the assessment and/or treatment.</p>
<p>2. Did the student use the CDMM? 3. How well? Ratings were unreliable and information was not helpful because "how the CDMM was used" was captured in the following questions. To perform any aspect of assessment and treatment, students must use aspects of the CDMM, even if they do not articulate it.</p>
<p>4. Did the decisions/procedures regarding the problem identification follow logically from previous steps? As with the above question, the answers were not particularly helpful. Students always had some "logical" steps, even if they sometimes leaped from assessment to treatment without outlining their objectives.</p>
<p>5. What was treatment based on?</p> <p><u>evidence (efficacy/biological, etc)</u></p> <ul style="list-style-type: none"> <li>student could refer to any level of evidence, but must indicate awareness of the evidence to support treatment choice. Simply stating that they used evidence was not adequate.</li> </ul> <p><u>client's clinical picture</u></p> <ul style="list-style-type: none"> <li>treatment was based on clinical signs and symptoms, e.g., client's hip abductors grade 4, and treatment was resisted exercises for this muscle group</li> </ul> <p><u>diagnosis (routine for condition)</u></p> <ul style="list-style-type: none"> <li>included routine orders from doctor, established clinical pathway</li> <li>included "recipes" without providing rationale or evidence – for example might provide strengthening of the knee extensors routinely, but there is no mention of loss of strength of these muscles</li> </ul> <p><u>client's concerns (client-centered)</u></p> <ul style="list-style-type: none"> <li>the treatment took into consideration the client's home or work situation or their desired goals</li> <li>e.g., the client complained about pain at work and the treatment involved education and problem-solving around changing the client's work environment</li> <li>e.g., the treatment was designed to fit in with the client's work or recreational schedule or ability</li> </ul> <p><u>preceptor/therapist experience</u></p> <ul style="list-style-type: none"> <li>student mentioned discussing treatment with preceptor or asking his/her advice or indicating that the preceptor had input into the treatment plan</li> </ul>
<p>6. Did the student state goals of treatment?</p> <ul style="list-style-type: none"> <li>indicated as "yes" if any goals mentioned at any point in the write up</li> </ul> <p>To determine whether the student used <u>measurable</u> goals, the following were evaluated:</p> <p><u>specific</u></p> <ul style="list-style-type: none"> <li>student mentions the joint, muscle, activity, etc – an objective such as "increase strength" would not be considered specific, but "increase strength of knee extensors" would</li> </ul> <p><u>outcome instrument</u></p> <ul style="list-style-type: none"> <li>student indicates how the outcome is to be measured, e.g., pain on a visual analogue scale, strength with a hand-held dynamometer</li> </ul> <p><u>change required for improvement/success</u></p> <ul style="list-style-type: none"> <li>e.g., decrease of pain by 3 cm on a 10 cm visual analogue scale</li> </ul> <p><u>time</u></p> <ul style="list-style-type: none"> <li>the expected time frame for the improvement, e.g., decrease in pain (as indicated above) in 2 weeks</li> </ul>
<p>7. Did the student evaluate the efficacy of the treatment program?</p> <ul style="list-style-type: none"> <li>rated as "yes" if student described how the effectiveness of the treatment was or "would be" evaluated.</li> </ul> <p>Were conclusions re: treatment efficacy based on:</p> <p><u>goals/specific outcomes</u></p> <ul style="list-style-type: none"> <li>based on achievement of a specific goal, e.g. a 3 cm decrease in the visual analogue scale for pain</li> </ul> <p><u>observation</u></p> <ul style="list-style-type: none"> <li>student mentions "change" but does not indicate a specific outcome to measure it, e.g., improved range of motion, client reports a decrease in pain, "client improved dramatically"</li> </ul> <p><u>preceptor OK</u></p> <ul style="list-style-type: none"> <li>the preceptor said the client improved or was ready for discharge or he/she performed some measures (not specific), e.g., measured range of motion</li> </ul> <p><u>other</u></p> <ul style="list-style-type: none"> <li>includes use of accepted critical pathway, or clinical guidelines or response of previous clients to this protocol</li> </ul>

8. Did decisions/procedures regarding treatment follow from evidence/logic from the previous step(s)? See comments for question 3 above.
9. Did the student find the guided reflection exercise useful? Why or why not? Indicated as "yes" if student reported any positive aspect of exercise. Indicated as "not stated" if the student did not answer the question. The narratives were more useful than the numbers.
10. Did the student find the CDMM useful? Indicated as "yes" if student reported any positive aspect of CDMM. Indicated as "not stated" if the student did not answer the question. The narratives were more useful than the numbers.
11. Quality of reflection/critical thinking? Comments and student reflections. Ratings were not particularly helpful. Students might reflect well on the establishment of one aspect, e.g., establishment of a diagnosis, but not on their evaluation of efficacy. Narratives were used to describe the students' thoughts.