

Clinical Reasoning: Survey of Teaching Methods, Integration, and Assessment in Entry-Level Physical Therapist Academic Education

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Background. Although clinical reasoning abilities are important learning outcomes of physical therapist entry-level education, best practice standards have not been established to guide clinical reasoning curricular design and learning assessment.

Objective. This research explored how clinical reasoning is currently defined, taught, and assessed in physical therapist entry-level education programs.

Design. A descriptive, cross-sectional survey was administered to physical therapist program representatives.

Methods. An electronic 24-question survey was distributed to the directors of 207 programs accredited by the Commission on Accreditation in Physical Therapy Education. Descriptive statistical analysis and qualitative content analysis were performed. Post hoc demographic and wave analyses revealed no evidence of nonresponse bias.

Results. A response rate of 46.4% (n=96) was achieved. All respondents reported that their programs incorporated clinical reasoning into their curricula. Only 25% of respondents reported a common definition of clinical reasoning in their programs. Most respondents (90.6%) reported that clinical reasoning was explicit in their curricula, and 94.8% indicated that multiple methods of curricular integration were used. Instructor-designed materials were most commonly used to teach clinical reasoning (83.3%). Assessment of clinical reasoning included practical examinations (99%), clinical coursework (94.8%), written examinations (87.5%), and written assignments (83.3%). Curricular integration of clinical reasoning-related self-reflection skills was reported by 91%.

Limitations. A large number of incomplete surveys affected the response rate, and the program directors to whom the survey was sent may not have consulted the faculty members who were most knowledgeable about clinical reasoning in their curricula. The survey construction limited some responses and application of the results.

Conclusions. Although clinical reasoning was explicitly integrated into program curricula, it was not consistently defined, taught, or assessed within or between the programs surveyed—resulting in significant variability in clinical reasoning education. These findings support the need for the development of best educational practices for clinical reasoning curricula and learning assessment.

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In an ever-changing and dynamic health care environment, physical therapists are increasingly held accountable for producing clinically significant improvements in their patients' functional outcomes. The clinical reasoning abilities used by physical therapists are perhaps the most critical component in the achievement of effective and efficient clinical outcomes. Entry-level doctor of physical therapy education continues to evolve with the aim of graduating new professionals who have clinical reasoning knowledge and abilities sufficient to enable them to succeed in their current professional roles and to make substantive contributions to the complex health care landscape of the future.

The American Physical Therapy Association (APTA) identifies *clinical reasoning* as a skill and practice expectation described in *A Normative Model of Physical Therapist Professional Education*.¹ The Commission on Accreditation in Physical Therapy Education (CAPTE) requires that all physical therapist education programs develop and assess clinical reasoning skills as a professional practice outcome expectation.² Recent work on the development of clinical reasoning skills during professional education and early practice in physical therapy described clinical reasoning as a process of professional development.³⁻⁵ This description supports the characterization of the clinical reasoning of physical therapists, as well as the teaching and learning of clinical reasoning, as a complex, interactive practice phenomenon involving more than simple cognitive processing skills.⁶⁻⁸ Given the complexity of preparing students for practice, the development of clear and comprehensive curricular guidelines for best practice standards in teaching and assessment of clinical reasoning would likely facilitate better and more consistent educational outcomes for new physical therapist graduates; at present, no such standards exist.

The terms *clinical reasoning*, *clinical decision making*, *diagnostic reasoning*, and *clinical judgment* have been used interchangeably in the health professions literature to describe the process by which a health care practitioner

decides what to think and do with a patient.⁹ Additionally, the intended outcome of this thought process varies by practice area. In medicine, the intended outcome is often a diagnosis; in nursing, it may be a plan of medical care; and in physical therapy, it may be a plan regarding how to intervene to maximize function. Given this variability in the intended outcome, it should be expected that the process involved in arriving at the intended outcome also varies. This variation makes it difficult to define clinical reasoning across disciplines; however, it can be argued that certain characteristics of the thought process are common across disciplines. A great deal of work regarding this thought process—which we refer to as *clinical reasoning* in this article—has been published for both nursing and medicine; a brief review of that work will serve to inform the reader about the current understanding of clinical reasoning across the health professions, as well as provide a rationale for the present study.

Benner et al¹⁰ summarized the various ways in which clinical reasoning has been defined in nursing as including a description by the National League for Nursing Accreditation—that is, the deliberate nonlinear process of collecting, interpreting, analyzing, drawing conclusions about, presenting, and evaluating information that is both factual and belief based. Additionally, the American Association of Colleges of Nursing has described clinical reasoning as including questioning, analysis, synthesis, interpretation, inference, inductive and deductive reasoning, intuition, application, and creativity.¹⁰ Benner et al¹⁰ added to these descriptions by characterizing clinical reasoning as occurring in a practice setting and with social relationships and requiring knowing and noticing what is salient. Cappelletti et al⁹ used the term *clinical judgment* to refer to an interpretation about a patient's needs, concerns, or health problems followed by a determined course of action. Koharchik et al¹¹ recently described 8 steps in clinical reasoning: looking, collecting, processing, deciding, planning, acting, evaluating, and reflecting.

As is the case in physical therapy, medicine has also not yet reached a consensus definition of clinical reasoning. *Diagnostic reasoning*, a term commonly used in medicine, was originally described as purely hypothetico-deductive in nature but has since been shown to also include recognition of clinical patterns and the development of illness scripts with exemplars from practice, involving both analytical and nonanalytical reasoning processes.¹²⁻¹⁴ Durning et al¹⁵ reported 3 findings relative to clinical reasoning in the medical literature: it depends on rich, content-specific knowledge organized as illness scripts and requires a variety of strategies as well as a tolerance for ambiguity and reflection. Durning et al¹⁶ also recently explicated the context specificity of expert clinical reasoning. These authors also noted that both mental processes and behavior are involved in decision making and that they are shared among the patient, the physician, and the environment.¹⁵

Learning theories providing the theoretical framework for understanding and for studying the development of clinical reasoning skills have been proposed to be constructivism and situational or experiential learning theories.¹⁵ Constructivism is grounded in the notion that meaningful learning occurs when learners create their own knowledge by experiencing things and reflecting on performance. Similarly, situational and experiential learning theories emphasize “learning to do” by solving problems in a clinical context.¹⁷

Various instructional strategies related to developing clinical reasoning skills have been investigated. In a systematic review of problem-based learning, the integrated curriculum, and concept mapping with students in the health professions, Rochmawati and Wiechula¹⁸ reported insufficient evidence to recommend any instructional strategy. Nursing literature supports the use of the teaching skill of “noticing,” described as the “perceptual grasp of the situation at hand,”^{19(p208)} to develop clinical reasoning skills. This goal is accomplished through the use of reflective questions, such as the following: What did you observe? What do you make of the situation? What course of

action will you take? This “noticing” also can be called “reflection,” which is supported across disciplines as both an instructional strategy and a skill to support the development of clinical reasoning. Reflection can be facilitated through debriefing and written or verbal reflective activities.

A goal of the Clinical Reasoning Curricula and Assessment Research Consortium (CRCARC) of the American Council of Academic Physical Therapy is the development of best practice standards for teaching and assessing clinical reasoning in physical therapist education. Having recognized the lack of consensus across the health professions literature and within its own membership about the meaning and scope of the term *clinical reasoning*, the members of the CRCARC involved in developing a research agenda identified the need for an operational definition of clinical reasoning. The intention was to facilitate the establishment of a common description to which researchers and research participants could refer when engaged in clinical reasoning research.

Members of the CRCARC first performed a literature review to explore whether a comprehensive definition of clinical reasoning already existed in the health professions literature. They sought to identify an existing definition that embodied the key aspects described in current clinical reasoning literature, such as its inherent complexity; the collaborative, interpersonal nature of clinical reasoning; its multiple interrelated components; and types of reasoning involved, such as deductive and inductive reasoning.^{6,8,20–24} When a comprehensive definition was not found, the members of the CRCARC identified published definitions across the health professions literature^{22,25–31} to use in developing a single operational definition (Appendix).

A subset of the members of the CRCARC drafted a definition and undertook an iterative process of receiving feedback, revision, and solicitation of additional feedback to guide ongoing revision of the definition. This process took place face-to-face during 3 consecutive consortium meetings and via written feedback

provided through the CRCARC's APTA online community page. Consensus was achieved in February 2012, and the following operational definition was adopted for use in upcoming CRCARC research:

Clinical reasoning is a nonlinear, recursive cognitive process in which the clinician synthesizes information collaboratively with the patient, caregivers, and the health care team in the context of the task and the setting. The clinician reflectively integrates information with previous knowledge and best available evidence in order to take deliberate action.

This definition is intended to reflect the ongoing cyclical nature of reasoning (nonlinear, recursive) and names the people involved in the interactive, collaborative process (such as the patient, caregivers, and other health care practitioners), as well as the nature of the task itself (movement analysis, function). Reflection, mutual decision making, and context (people involved, task, and setting) are included in this operational definition as influential components of clinical reasoning. The roles of types of cognition and metacognition involved, including deductive reasoning, inductive reasoning, critical thinking, and reflection, are collectively expressed in this definition through the use of the terms *cognitive process*, *synthesizes*, and *integrates*. The term *deliberate action* signifies the moral/ethical aspect of decisions made and actions taken after consideration and determination of the best course of action for and with a particular person, including consideration of the person's values and priorities, in the context of his or her current situation.

The CRCARC also recognized the existing lack of consensus or evidence-based standards of educational practice for curricular design, teaching methods, and assessment of students' learning of clinical reasoning in physical therapist professional education. Consistent with its goal to contribute to the establishment of such guidelines, the CRCARC identified—as a first step—the need to understand the current state of clinical reasoning in physical therapist education throughout the United States. Therefore,

the purpose of this research was to explore how clinical reasoning is currently defined, taught, and assessed in the professional education of physical therapists. The intent of this first step was to provide insight into the current state of clinical reasoning in the academic component of entry-level physical therapist education programs; this insight could be used as a baseline for future research and collaborative work toward establishing best educational practices for the teaching, learning, and assessment of clinical reasoning.

Method

For this research, a descriptive, cross-sectional survey design was used, and both quantitative and qualitative data were gathered. The survey tool was designed specifically for this project; its development is further described in the next section.

Development of the Survey

Survey questions were created by members of the CRCARC of the American Council of Academic Physical Therapy. A subset of the members of the CRCARC then refined the survey to consist of a total of 24 questions, including 15 directly related to clinical reasoning and the remainder focused on institutional demographics and contact details. A survey draft was entered into SurveyMonkey³² online survey administration software and was reviewed for question order, clarity, language, and skip logic by a research assistant experienced in survey design and administration. The electronic version of the survey was pilot tested by consortium members and revised again to enhance clarity. The final version of the survey was prefaced with an introductory statement and divided into the following sections: Clinical Reasoning Defined (4 branched questions), Curricular Design (5 branched questions), Assessment of Self-Reflection Skills (2 branched questions), Assessment of Clinical Reasoning Skills (3 branched questions), Wrap-Up (1 open-ended question) and Demographics (6 questions), and Contact Information (3 questions). The survey questionnaire is shown in the [eAppendix](#) (available at academic.oup.com/ptj).

Table 1.Demographics of Survey Respondents and Corresponding CAPTE Aggregated Institutional Demographic Data^{33,a}

Characteristic	% of Survey Respondents ^b	% According to CAPTE 2012–2013 Fact Sheet ^b
Type of institution		
Public	51.5	51.3
Private	48.5	48.7
Carnegie classification		
Research	36.1	28.1
Master's	35.1	40.3
Special school	15.5	16.7
Doctoral	11.5	10.6
Other	2	4.3
Curriculum model (may select more than one)		
Hybrid	68.8	72.5
Traditional	21.9	12
Systems based	21.9	9
Modified problem based	11.8	3.5
Guide based	9.4	1
Case based	18.8	0.5
Problem based	11.8	1.5
Life-span based	10.4	0
Class size (no. of students) ^c		
<31	16.7	
31–40	34.4	
41–50	15.6	
51–60	16.7	
61–70	5.2	
≥71	8.3	
Unspecified	3.1	
No. of core faculty members ^d		
<6	4.2	
6–10	54.2	
11–15	29.2	
16–20	9.4	
>20	3.1	
Who completed survey		N/A
Program director	68.8	
Curriculum committee member	11.5	
Director of clinical education	4.2	
Other	15.3	

^a CAPTE=Commission on Accreditation in Physical Therapy Education, N/A=not applicable.^b Totals for the survey data may not equal exactly 100% due to rounding to one digit to the right of the decimal point.^c Range=0–148, \bar{X} =37.1.^d Range=4–30, \bar{X} =10.5.

Survey Administration

A list of the email addresses of the directors of the 207 CAPTE-accredited physical therapist education programs in the United States and Puerto Rico was obtained from APTA. In June 2012, the first request for participation was emailed to potential participants; included were a brief explanation of the purpose of the survey, the timeline for completion, a link to the survey, contact information for the primary researchers, and a detailed informed consent letter. Additionally, in an effort to gather accurate information, program directors were asked to forward the survey to the member of the faculty in their curriculum who was most familiar with clinical reasoning (for that person to complete). The survey link was uniquely tied to the recipient's email and internet provider addresses to prevent duplication of responses. Collected data were de-identified by a research assistant before analysis to ensure the anonymity of the responses.

Three subsequent waves of email reminders were sent, in January 2013, July 2013, and October 2013, to maximize the response rate. In May 2013, new contact details for 12 program directors who had not yet responded were obtained, and introductory emails were sent to them. The research team also contacted the remaining nonrespondents via telephone and resent personalized email invitations to them in May 2013 and June 2013 to request a response to the survey.

Survey Respondents

The directors of 9 of the 207 programs accredited by CAPTE at the time of our survey permanently opted out of Survey-Monkey. Of the 123 people who responded to the survey, 27 terminated participation within the first few questions. Ninety-six respondents completed the survey, yielding a response rate of 46.4%.

Tables 1 and 2 provide demographic descriptions of programs provided by the survey respondents, along with comparison data from the CAPTE 2012–2013 Fact Sheet.³³ Because the survey respondents were allowed to choose all of the

Table 2.Geographic Locations of Programs and Corresponding CAPTE Aggregated Institutional Demographic Data^{33,a}

Location	% of Survey Respondents ^b	% According to CAPTE 2012–2013 Fact Sheet ^b
New England: CT, MA, ME, NH, RI, VT	8.6	7.7
Middle Atlantic: NJ, NY, PA	15.7	18.6
East North Central: IL, IN, MI, OH, WI	12.9	14.5
West North Central: IA, KS, MN, MO, NE, ND, SD	7.1	10.0
South Atlantic: DC, DE, FL, GA, MD, NC, PR, SC, VA, WV	12.9	20.0
East South Central: AL, KY, MS, TN	7.1	6.4
West South Central: AR, LA, OK, TX	11.4	9.1
Mountain: AZ, CO, ID, MT, NV, NM, UT, WY	10	4.1
Pacific: AK, CA, HI, OR, WA	12.9	8.2

^a CAPTE=Commission on Accreditation in Physical Therapy Education.^b Total percentage does not equal 100% because only programs in the United States were included (1.4% was “other” [ie, Canada, Scotland], which is not relevant to include for our national survey).

types of curriculum models represented in their curricula, the total percentage for curriculum model data was greater than 100%. For this reason, we were unable to compare our survey data for this item with the published CAPTE data, which reflects one primary curriculum model per program. We were able to determine geographic data for only 94 of the 96 respondents, as we were unable to track the locations of programs for 2 program directors.

Data Analysis

Descriptive statistics were determined for quantitative data, with some assistance from the analysis and reporting functions within SurveyMonkey.³² A systematic content analysis of responses to open-ended questions was performed. For the narrative responses describing the definition of clinical reasoning used within individual programs (eAppendix, survey question 1.2.1), a conventional content analysis approach was chosen, as researchers derived codes from the data inductively.³⁴ This inductive approach began with an open coding process to describe all aspects of the data.³⁵ This phase of the analysis involved an iterative process with 5 of the researchers. First, each researcher coded the data individually, and then the researchers compared and discussed the coding results. This process led to refinement of the codes. When possible, codes

that shared common meanings were grouped into broader categories, and themes were developed to represent the meaning in each.³⁶

To test the credibility of the analysis, 2 of the researchers again assigned codes and themes to the data according to the consensus-derived coding and theme categories, and their results were audited by a third researcher; 100% agreement was achieved. The number of times that each code or theme was represented in the data also was recorded as a way of describing the level of agreement or variability in the content of the narrative responses. We conducted the quantitative and qualitative data analyses and interpretations via regular teleconference calls and face-to-face meetings.

Nonresponse Bias Post Hoc Analysis

According to Draugalis and Plaza,³⁷ to allow us to confidently assume representativeness of the entire population sampled solely on the basis of the response rate, a response rate of at least 64% would have been needed, given the size of the population. Ninety-six respondents completed the survey, resulting in a response rate of 46.4%. This result necessitated consideration of potential nonresponse bias in the data.³⁸

A recent trend toward lower survey response rates has been documented and is thought to be due, at least in part, to survey fatigue as a result of oversurveying in many fields, which has led to the inability to respond to some or all requests to participate or to the tendency to ignore all requests.³⁹ It can be argued that directors of physical therapist education programs represent such an oversurveyed group. Given this trend, the survey research literature has proposed that reliance solely on the response rate to determine the validity or potential representativeness of survey data is an overly simplistic and superficial approach, and supplemental post hoc analysis methods have been proposed to assist researchers in detecting whether there are indications of nonresponse bias in data collected through surveys with less-than-optimal response rates.³⁸

Therefore, a post hoc analysis of the data was conducted to detect signs of nonresponse bias; both a demographic representativeness analysis and a wave analysis were performed.³⁸ The demographic characteristics of programs that participated in the survey were compared with the national aggregated demographic data for all programs, as reported by CAPTE³³ (Tab. 1), and were judged to be adequately similar in all of the categories.

The wave analysis involved examining the data to determine whether the responses of people who responded after multiple reminders or telephone solicitations differed from the responses of those who responded to the initial survey solicitation. The premise of this type of analysis is that people who respond after multiple reminders are more likely not to respond without all of the reminders; therefore, they are more likely to be similar to survey nonresponders. If a wave analysis shows that the responses of the final wave of responders to a survey are not different from those of the people who responded to the survey in the first wave, then there is support for researchers to consider that a problem with nonresponse bias is unlikely.³⁸ The survey data were examined, and the data provided by the final wave of respondents were consistent with those provided by the initial wave

Table 3.

Themes Representing Distinct Components of Clinical Reasoning Included in Curricular Definitions of Clinical Reasoning

Theme	No. of Instances
Involves a process of steps toward solving a clinical problem	13
Results in making a decision that leads to action	12
Involves gathering of data from multiple sources	7
Relates to a specific practice/decision-making model	7
Use of evidence	5
Application of knowledge	4
Definition grounded in a specific definition in the literature (Higgs and Jones ²²)	4
Collaborative	3
Use of critical thinking	3
Embedded in practice tasks/actions	2
Contextual	2

of respondents. Therefore, no evidence of nonresponse bias was detected through these post hoc analyses.

Results

Definition of Clinical Reasoning

The respondents were asked whether their programs incorporated clinical reasoning into their curricula and, if they responded affirmatively, whether a common definition of clinical reasoning was used across their curricula. All respondents ($n=96$) reported incorporating clinical reasoning into their curricula; however, only 25% of respondents ($n=24$) indicated that a common definition of clinical reasoning was used. Therefore, 75% ($n=72$) of respondents reported that their programs did not define clinical reasoning consistently across their own curricula, suggesting potential variability in how clinical reasoning is defined within each institutional curriculum.

The 25% of respondents representing programs that did use a common definition of clinical reasoning across their curricula were then asked to provide their programs' definitions. Table 3 shows the themes representing the various components of clinical reasoning identified through analysis of the narrative responses to this question. The number of times that each theme was identified in a definition is provided to represent how

commonly each theme appeared across all definitions of clinical reasoning provided by the respondents.

As illustrated by the themes included in the 24 narrative definitions of clinical reasoning provided by respondents (Tab. 3), there was a high degree of variability in content among the responses. It is likely that this variability was related, in part, to the brief, decontextualized nature of the narrative responses received. Even the most commonly included theme, "Involves a process of steps toward solving a clinical problem," was included in only 13 of the responses provided. Individual codes within the theme "Relates to a specific practice/decision-making model" were variable, and the 7 codes within that theme included the following: *International Classification of Functioning, Disability and Health* (ICF),⁴⁰ evidence-based practice,⁴¹ the Patient-Client Management Model,⁴² the Nagi Disablement Model,⁴³ the Hypothesis-Oriented Algorithm for Clinicians,⁴⁴ and a curriculum-specific, self-developed practice model.

In keeping with a qualitative approach to data analysis of the narrative responses, our intent was to represent all of the data obtained within the analysis; however, because of the high degree of variability in the data, we were unable to subsume each individual code identified into

emergent themes. Codes identified in only one of the narrative responses describing how programs defined clinical reasoning included the following: clinical reasoning is deductive, clinical reasoning includes reflection on prior experience, and clinical reasoning includes learning as an outcome.

The respondents representing programs that did use a common definition of clinical reasoning across their curricula were then provided with the definition of clinical reasoning developed by the CRCARC and asked whether the definition was consistent with how their programs defined clinical reasoning. Interestingly, despite the high degree of variability represented in the content of the definitions provided by the respondents, 22 of these respondents responded affirmatively, indicating that the CRCARC definition was consistent with their various programs' definitions.

Curricular Integration of Clinical Reasoning Skills

The respondents indicated the ways in which their programs incorporated clinical reasoning into their curricula by using the CRCARC definition as a common reference definition. All respondents reported that their programs integrated clinical reasoning into their curricula, and most (90.6%) reported that they made it explicit in their curricula; 29.2% of the programs had a separate course on clinical reasoning; and 94.8% of respondents reported that multiple methods were used to achieve this integration. Figure 1 provides a description of the combinations of the methods used.

Ninety-eight percent of respondents reported that one or more frameworks were used to teach clinical reasoning. The *Guide to Physical Therapist Practice* Patient-Client Management Model⁴² (93.8%) and the World Health Organization ICF⁴⁰ (93.8%) were the 2 most commonly named frameworks. The respondents were given an opportunity to mention "other" frameworks that were used but that were not included as choices for responses in the survey question. The variety of responses represented a high degree of variability in the

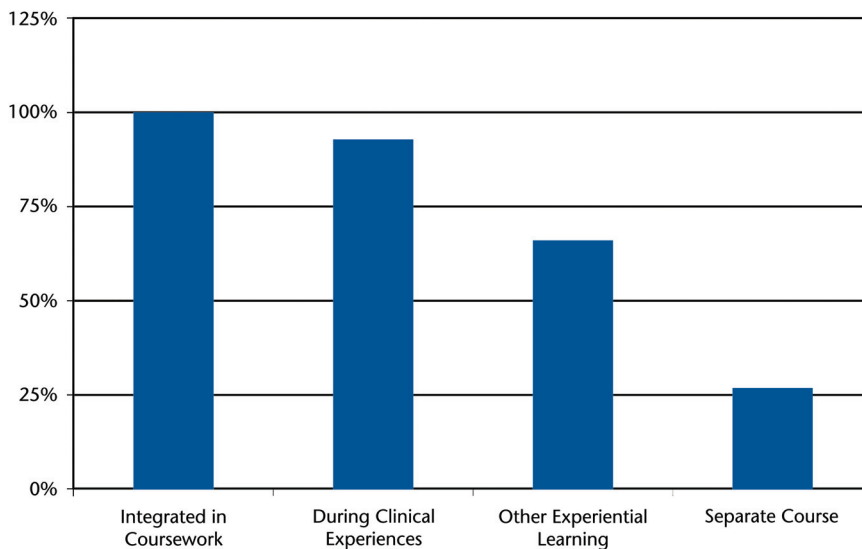


Figure 1.
Percentages of pedagogical methods used to integrate clinical reasoning into curricula.

frameworks used to teach clinical reasoning across and within curricula. The breadth of this variability is shown in Table 4, in which the examples provided by the respondents as “other” frameworks are shown, along with the number of appearances in the data. Many of these responses included parts or all of a practice/decision-making model previously referenced in the survey (eAppendix, survey question 4).

The respondents were asked to identify tools or materials used to teach clinical

reasoning skills. The materials used are presented in Figure 2. All respondents who reported using tools or materials indicated using more than one tool or material. The respondents were given an opportunity to mention “other” tools that they used but that were not included as choices for responses in the survey question. Six respondents reported not using materials or tools, and 10 reported using other materials, including simulations, program competencies, conceptual frameworks, and textbooks on

evidence-based practice and differential diagnosis.

Assessment of Clinical Reasoning Skills

All respondents indicated that faculty members assessed clinical reasoning skills using a variety of methods, including practical examinations (99%), clinical affiliations or fieldwork (94.8%), written examinations (87.5%), and written assignments (such as literature reviews or other papers) (83.3%). When asked to indicate whether a specific tool was used to assess clinical reasoning skills, all respondents reported using a tool and 94.8% reported using more than 1 tool. The APTA’s Physical Therapist Clinical Performance Instrument (PT CPI)⁴⁵ and self-designed grading rubrics were the most commonly used materials (92.7% and 85.4%, respectively); next were self-designed grading scales (43.8%) and standardized tools, such as the Watson-Glaser Critical Thinking Appraisal⁴⁶ (10.4%).

Self-Reflection

Ninety-one percent of respondents reported that they incorporated into their curricula self-reflection skills specifically related to clinical reasoning. When asked whether they used a framework to develop grading criteria for the assessment of reflective skills, they reported a wide variety of items, including a 360-degree self-assessment tool, self-developed rubrics, the ICF,⁴⁰ the *Guide to Physical Therapist Practice*,⁴² the Mezirow framework,⁴⁷ the PT CPI,⁴⁵ and program-specific models and competencies. However, 45% reported that they did not use a specific framework to develop grading criteria for the assessment of self-reflection skills.

Finally, the respondents were asked whether there was anything else that they would like to report regarding clinical reasoning in their respective curricula. Three respondents reported that their programs were actively working on improving the integration of clinical reasoning into their curricula. Another reported that their students completed a critical thinking workshop yearly while in the program. Two respondents expressed an interest in learning more about integrating clinical reasoning

Table 4.
Clinical Reasoning (CR) Framework Responses^a

Framework	% (n) of Respondents Using It
<i>Guide to Physical Therapist Practice Patient-Client Management Model</i> ⁴²	93.8 (90)
<i>International Classification of Functioning, Disability and Health</i> ⁴⁰	93.8 (90)
Nagi Disablement Model ⁴³	61.5 (59)
Hypothesis-Oriented Algorithm for Clinicians ⁴⁴	55.2 (53)
Other: CR literature citations (n=3), ^{6,35} some of the frameworks listed (n=2), hypothetico-deductive reasoning (n=3), CR strategies (n=2), ⁵ evidence-based practice (n=1), problem-based learning (n=1), pattern recognition (n=1), critical thinking ³⁶ (n=1), patient-practitioner collaborative model (n=1), ³⁷ movement system diagnosis (n=1), and the Palisano collaborative model of service delivery and self-designed motor control theory-based model (n=1)	17.7 (17)
Integrated framework for decision making in neurologic physical therapist practice ⁴⁹	16.7 (16)
None	2 (2)

^a Respondents could choose more than one response.

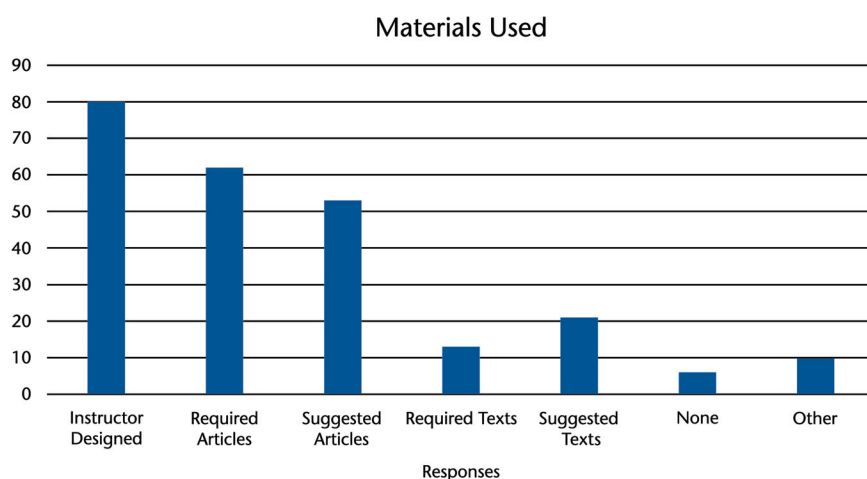


Figure 2. Materials used to teach clinical reasoning. Data are numbers of respondents.

throughout their programs, and one stated that it is important to “learn by doing/practice (with mentoring) rather than trying to teach clinical reasoning by talking about how it is done. . . .” Modeling, problem-based learning, recognition of the need to incorporate societal factors, and the need for a basis in neuroscience were also mentioned as important factors to consider with regard to the teaching and learning of clinical reasoning.

Discussion

The results of the present study indicated that academic programs agree that clinical reasoning is an important component of a curriculum. However, there was a high level of variability in the ways in which clinical reasoning was defined, taught, and assessed throughout the physical therapist education programs surveyed. Most respondents (75%) indicated that their programs did not use a common definition of clinical reasoning uniformly within their own curriculum, and the definitions provided by the respondents whose programs did use a common definition within their own curriculum were not consistent between programs. Clinical reasoning is a highly complex concept, so it is not surprising that there was substantial variability in how programs defined it; however, the variability in how clinical reasoning was described was also reflected in variability in how it was taught and assessed.

Given the profession’s relatively nascent development of an understanding of clinical reasoning and limited research into associated teaching, learning, and assessment in professional programs, the lack of a common definition is not surprising. However, it is possible that core elements, skills, and successful educational strategies can be described and agreed upon within the profession. These core elements could then be used as a basis for research across programs to develop an understanding of best practices for teaching and assessing clinical reasoning.

In addition, some of the definitions provided by the respondents could be interpreted as equating various practice models (eg, the ICF model⁴⁰) with clinical reasoning itself. This interpretation may indicate a lack of understanding that various practice models are not synonymous with clinical reasoning itself, although clinical reasoning is implicit in some of these models. Of concern in this scenario is the oversimplified understanding of clinical reasoning that can result when it is “fit into” or assumed to have been implied in a practice model representation but is not explicitly included as part of the model. Oversimplifying a complex, abstract concept is often recommended in the teaching of beginners, but it is important that the development of understanding and abilities not stop at the simple level. Education for the development of clinical

reasoning must strategically facilitate learners’ progression from simple to complex levels of understanding and skill development. For example, the use of various practice models to describe clinical reasoning itself may overlook or deemphasize important component skills of clinical reasoning, such as critical reflection or other metacognitive skills inherent in excellent (expert) clinical reasoning.

The integration of clinical reasoning into curricula and the assessment of clinical reasoning were reported across all programs represented in the survey, consistent with the requirements stated in current CAPTE accreditation standards.² Most commonly, multiple methods were used in the teaching, learning, and assessment of clinical reasoning. Most respondents (98%) reported using 1 or more frameworks to teach clinical reasoning. However, as mentioned earlier, the frameworks cited by most respondents do not explicitly describe the clinical reasoning involved in them; therefore, we were unable to determine, from the survey data, exactly how these frameworks were used to teach clinical reasoning.

The most commonly used teaching materials were instructor derived. Although it is likely that multiple resources and methodologies are required to promote the development of clinical reasoning in different types of learners, the survey findings indicated substantial variability in teaching methodologies. There are a few explanations for why most programs’ educators created their own materials. One reason is the variability in how clinical reasoning is conceptualized. Variability in conceptualization will lead to variability in what is taught and how it is taught. A second reason is that educators may believe that the available resources are inadequate or may not agree with them because they have a different understanding of clinical reasoning. The literature related to teaching clinical reasoning, especially in physical therapy, is sparse and often related to a particular practice area (eg, orthopedic, neurologic). The survey findings indicate a need for research related to best practices to promote the development of

clinical reasoning skills across practice settings.

Aside from the common usage of the PT CPI⁴⁵ to assess clinical reasoning in clinical education experiences, clinical reasoning assessment methods were also mostly self-designed and were specific to instructors and programs. Some methods of assessment, such as literature review papers and standardized, non-clinically based tests of critical thinking, did not appear to be consistent with an assessment of clinical reasoning; this finding raised the question of whether some respondents were equating assessment of critical thinking with assessment of clinical reasoning. Although the PT CPI is a standardized assessment tool used to assess clinical reasoning in the context of clinical practice (in addition to other practice skills and behaviors), there is an inherent lack of detail and specificity for the various aspects of clinical reasoning within the PT CPI criteria. The PT CPI is designed to determine a single global rating of a student's clinical reasoning; therefore, although the tool is standardized, it is likely that the outcomes determined may indicate a wide variety of different strengths and weaknesses in various aspects of the clinical reasoning of a student receiving a single global rating. It is therefore impossible to use the PT CPI to accurately interpret levels of achievement of specific clinical reasoning learning outcomes.

A similar pattern of variability was reported for assessment methods, specifically, those for self-reflection skills, which are key components in the teaching and learning of clinical reasoning. Examples of frameworks or models used were not specific for self-reflection or grounded in relevant educational theory, and 45% of respondents reported using no specific framework to guide their assessment of self-reflection skills. These findings indicated that, despite the fact that most (90%) of the programs included self-assessment as a component of their clinical reasoning curricula, the assessment of learning outcomes related to the development of self-reflection skills in these curricula was not adequate.

Given the variability in teaching methods and materials and the variability in the understanding and descriptions of clinical reasoning reported by the respondents, the corresponding level of inherent individuality in the self-developed assessment materials was not surprising. This finding may indicate that many educators were continually investing time and energy in creating and re-creating their own clinical reasoning educational and assessment methods and materials. The lack of consistency in both teaching methods and assessment methods contributed to difficulties in researching the validity of assessment methods between programs and in comparing the outcomes of various clinical reasoning educational strategies with the goal of shaping recommendations for evidence-based educational practices.

Physical therapist educators recognize the importance of teaching and assessing clinical reasoning skills. However, a substantial amount of work needs to be done to improve the focus and quality of clinical reasoning instruction and assessment. Within the physical therapy profession, the understanding of the nature and development of clinical reasoning is still relatively underresearched; consequently, a consensus definition has not yet been developed. Building an evolving understanding of the nature of clinical reasoning and of core skills related to clinical reasoning, referenced to the continuum of novice to expert practice, is necessary to assist physical therapist educators in improving teaching, learning, and assessment strategies for clinical reasoning. Establishing core skills and abilities across a continuum of development can also contribute to the development of best practices for teaching and assessment in association with expected outcomes for specific educational levels.

Limitations

The potential for nonresponse bias was acknowledged and addressed by the post hoc analyses performed on the survey responses. The potential for response bias in the data also was considered; potential survey respondents who had a high level of interest in the survey topic would have been much more likely to respond.^{37,48} Therefore, it is possible

that people who completed the survey had a greater familiarity with the topic of clinical reasoning than those who did not complete or did not respond to the survey. Given that our data may have represented a bias toward respondents with a higher-than-average level of familiarity with or understanding of clinical reasoning and given that the survey data were characterized by a high degree of inconsistency and lack of familiarity with or understanding of definitions, models, or frameworks specifically related to clinical reasoning, the potential implication is that the average level of understanding of clinical reasoning was perhaps even more variable than that represented by the results of the survey.

Another limitation of the present study was the relatively large number of incomplete surveys submitted; 27 of the 123 surveys started were terminated after the first few questions (22%). A hypothesized reason for the high rate of incomplete surveys was the potential perception that the survey questions about the clinical reasoning curriculum were too difficult or too time-consuming to easily complete in one sitting or for one person to easily complete. A respondent who did not have the information requested on the survey conveniently available or who required consultation from another faculty member in order to respond might have stopped the survey and neglected to complete it at a later time.

A related limitation was the assumption that, because the survey was addressed to program directors and because they were asked to respond or pass the survey along to a faculty representative knowledgeable about the clinical reasoning curriculum in their program, the response from each program would be representative of that program. Given that only 25% of respondents indicated that there was a common definition of clinical reasoning within their own programs, it is likely that our data did not capture all of the conceptions of clinical reasoning within programs.

Our survey instrument was limited in 2 ways. The first was that, to establish a common, operational definition of clinical reasoning to which all respondents

could refer while completing the survey, the researchers engaged in a consensus-based process within the CRCARC membership to generate an operational definition. Therefore, this process was intentionally limited, and critical feedback on the definition was not sought outside the consortium membership. These circumstances limited the extent to which the operational definition could be considered valid beyond the CRCARC.

The second limitation of the survey instrument was attributable to the construction of survey question branching. The data analysis of content and conclusions about the association of the degree of variability with the way in which clinical reasoning was defined within programs were limited to programs with common definitions by virtue of the branching of the survey questions (ie, only respondents who indicated that a common definition was used within their curricula were then asked for that definition). In addition, respondents from programs that did not have one common definition but perhaps had multiple definitions were not asked to share their definitions. This condition may have influenced our interpretation of the amount of variability in the ways in which clinical reasoning within programs was understood as well. Therefore, we could not know what might have been common among the entire pool of multiple definitions in use, and our observations of variability were limited accordingly.

The present study was aimed at exploring what and how professional physical therapist students are taught about clinical reasoning in the academic setting and ways in which their learning is assessed. Although some data related to the assessment of clinical reasoning during the clinical education component of programs were reported, the survey was limited in that it did not directly solicit data from clinical educators affiliated with academic programs.

In conclusion, physical therapist education programs may benefit from the collaborative development of a common definition for and understanding of the

term *clinical reasoning* within the profession. Also beneficial would be the establishment of curricular guidelines linked to optimal entry-level clinical reasoning learning outcomes or competencies. Teachers and learners could also benefit from the development of recommended materials and methods for achieving and assessing these desired learning outcomes. Such collaboration would facilitate the development of a body of sound educational research to determine best practices for the teaching and learning of clinical reasoning.

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All authors provided concept/idea/research design, writing, and data analysis. Dr Christensen, Dr Black, Dr Furze, and Dr Wainwright provided data collection. Dr Wainwright provided project management, facilities/equipment, and administrative support. Dr Furze and Dr Vendrely provided consultation (including review of manuscript before submission).

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Ethics Approval

The research was reviewed and approved by the institutional review boards at Creighton University; Rutgers, The State University of New Jersey; Samuel Merritt University; and Thomas Jefferson University.

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Appendix.

Published Definitions Across the Health Professions Literature Used in Developing a Single Operational Definition of Clinical Reasoning

The following definitions are those from which the Clinical Reasoning Curricula and Assessment Research Consortium chose to construct a consensus definition of clinical reasoning.

- The thinking and decision-making process used during the examination and treatment of patients.²⁸
- It is influenced by the task, the setting, the patient, and the decision maker.²²
- A purposeful, self-regulated, nonlinear, recursive cognitive process that a person uses to make a decision about what to do in a given context.²⁵
- The intellectual activity that synthesizes information obtained from the clinical situation, integrates it with previous knowledge and experiences, and uses it for making diagnostic and management decisions.³⁰
- Clinical reasoning is defined as a complex cognitive process that uses formal and informal thinking strategies to gather and analyze patient information, evaluate the significance of this information, and determine the value of alternative actions.³¹
- Clinical reasoning is a process in which the clinician, interacting with significant others (client, caregivers, health care team members), structures meaning, goals, and health management strategies on the basis of clinical data, client choices, and professional judgment and knowledge.^{22(p11)}
- Clinical reasoning is the sum of the thinking and decision-making processes associated with clinical practice; it is a critical skill in the health professions, central to the practice of professional autonomy, and it enables practitioners to take “wise” action—meaning taking the best judged action in a specific context.^{26,27}
- The capacities to reason in the context of uncertainty and to solve ill-defined problems are the hallmarks of professional competence.²⁹