Evidence of Reliability, Validity, and Practicality for the Canadian Physiotherapy Assessment of Clinical Performance

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ABSTRACT

Purpose: To investigate the internal consistency, construct validity, and practicality of the Canadian Physiotherapy Assessment of Clinical Performance (ACP), a descriptive measure used by physiotherapy students and their clinical instructors (CIs) at the mid- and endpoints of an internship to describe the students' behaviours as observed in the clinical education setting relative to what might be expected of an entry-level physiotherapist. **Methods:** This multi-centre study piloted the ACP in 10 university physiotherapy (PT) programmes. Both CIs and students undertaking clinical internships completed the ACP and the current tool, the Physical Therapist Clinical Performance Instrument (PT-CPI; Version 1997). **Results:** CIs assessing PT students' performance during internships representing a variety of areas of practice completed the ACP at the midpoint ($n = 132$) and the endpoint ($n = 126$) of the internship. The end-of-internship sample consisted of 55 junior, 30 intermediate, and 41 senior students. The ACP demonstrated strong internal consistency: Alpha coefficients for each role ranged from 0.94 to 0.99. Aligned items on the ACP and PT-CPI were significantly correlated ($r = 0.51$ – 0.84). Senior PT students performed significantly better than intermediate students, who, in turn, performed better than junior students ($p < 0.0001$). Effect sizes for midpoint to final scores on the ACP ranged from medium to large (0.40–0.74). Participants were satisfied with the online education module that provided instruction on how to use and interpret the ACP, as indicated by satisfaction scores and qualitative comments. **Conclusions:** The ACP is a reliable, valid, and practical measure to assess and describe the PT students' behaviours as observed during clinical education relative to what is expected of an entry-level physiotherapist.

Key Words: educational measurement; internship and residency; students.

RÉSUMÉ

Objectif : Examiner la cohérence interne, la validité de construit et l'utilité pratique de l'évaluation de la performance clinique (EPC) en physiothérapie au Canada, une mesure employée par les étudiants en physiothérapie et leurs instructeurs cliniques en milieu et en fin de stage clinique pour décrire les comportements des étudiants par rapport à ce qu'il y a lieu d'être attendu d'un physiothérapeute débutant. **Méthodes :** Cette étude multicentrique évaluait la mise à l'essai de l'EPC dans 10 programmes universitaires. Les instructeurs cliniques et les étudiants en stage clinique ont réalisé leurs évaluations à l'aide de l'EPC et de l'outil actuel, le PT-CPI (version 1997). **Résultats :** Des instructeurs cliniques représentant différents champs de pratique ont complété l'EPC en milieu ($n = 132$) et en fin ($n = 126$) de stage. L'échantillon de fin de stage était composé de 55 étudiants débutants, 30 étudiants intermédiaires et 41 étudiants avancés. L'EPC a démontré un haut degré de cohérence interne, soit des coefficients alpha de 0,94 à 0,99 pour chaque rôle. Une corrélation significative a été observée entre les éléments correspondants de l'EPC et du PT-CPI ($r = 0.51$ – 0.84). Les étudiants avancés ont obtenu des résultats significativement meilleurs que les étudiants intermédiaires qui ont à leur tour obtenu des résultats significativement meilleurs que les étudiants débutants ($p < 0.0001$). Les différences constatées entre les notes de l'EPC en milieu et en fin de stage révèlent une taille d'effet moyenne à forte (0,40 à 0,74). Les notes de satisfaction et les commentaires qualitatifs indiquent que les participants étaient satisfaits du module de formation en ligne qui expliquait comment utiliser et interpréter l'ACP. **Conclusions :** L'EPC est une mesure fiable, valide et pratique pour évaluer et décrire les comportements des étudiants observés en formation clinique par rapport à ce qu'il y a lieu d'attendre d'un physiothérapeute débutant.

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Assessment is an important component in the clinical education process, providing feedback to the learner to reinforce areas of strength and identify areas for improvement. Formal assessment encourages observation of the student's performance by the clinical instructor (CI) and allows the student and CI to discuss the student's performance.

Typical development stages for a new measure include item selection, item reduction, development, pre-testing, and testing.¹ We have described the initial phases of development for the Canadian Physiotherapy Assessment of Clinical Performance (ACP) in two previous articles.^{2,3} The first of these articles² described Phases 1 and 2. In Phase 1, we recruited an expert consultant panel to participate in a study using the Delphi approach to gain consensus on the rating scale, the items that would make up the measure, and the number and placement of the comment boxes. However, because this panel was so intimately engaged with the concepts of the Essential Competency Profile for Physiotherapists in Canada⁴ (ECP) and with clinical education and assessment, we also sought face and content validity from future users of the measure in Phase 2, through interviews with a variety of stakeholders including CIs, recent graduates, and experts in clinical education and measurement. Phases 1 and 2 produced a first draft of the assessment measure that included a total of 16 rating scales, assessing seven roles, and nine comment boxes. Using this draft, Phase 3³ investigated the face and content validity of the draft measure through broad consultation with physiotherapists across Canada who had supervised and assessed at least one student in clinical practice in the previous 12 months. The results of Phase 3 were used to develop the version of the ACP that would be field tested.

The ACP is an assessment measure based on the ECP. The ECP is a national document that

describes the essential competencies (i.e., the knowledge, skills and attitudes) required by physiotherapists in Canada at the beginning of and throughout their career. It also provides guidance for physiotherapists to build on their competencies over time. The Profile reflects the diversity of physiotherapy practice and helps support evolution of the profession in relation to the changing nature of practice environments and advances in evidence-informed practice.^{4(p.4)}

The ACP is to be used by both physiotherapy (PT) students and their CIs to assess and describe the students' clinical performance behaviours as observed in the clinical education setting, relative to what is expected of an entry-level physiotherapist, across the student's academic programme. The ACP assesses seven PT roles (domains and subscores), each with 1 to 8 competencies, for a total of 21 competencies; it is scored as a profile across roles. The ACP is administered twice during each clinical intern-

ship in the curriculum. The goal of the measure is to describe the level of performance relative to the standard rather than to assess the magnitude of change; it is therefore intended to be used as a discriminative measure,⁵ with repeated descriptions at different points in time along the student's clinical education curriculum.

Because the Clinical Education Guidelines for Canadian University Programs specifies that each student must acquire significant clinical experience in a variety of practice areas and settings,⁶ the ACP needed to be useful in a variety of clinical education internships across Canada, ranging from acute care to community care and covering all areas of clinical practice (e.g., musculoskeletal, cardiorespiratory, neurological). The scores on the measure (competency and role) are out of 10, and an entry-level physiotherapist is expected to perform at a minimum of 9 of 10 on all key competencies. A list of items from the ACP and a sample page are included in Appendix 1. The purpose of this study was to assess and report on the overall performance of the ACP—specifically, its internal consistency, construct validity, and practicality when completed by CIs—as detailed in our *a priori* table of hypotheses (see Box 1).

Two popular paradigms are used to assess validity: a health measurement⁷ (often called a psychometric or classic) approach and an educationalist⁸ (often called a modern) approach. Although the techniques used to establish test-retest reliability or correlation with another construct are the same, the approach to validity is different: Whereas the health measurement approach typically emphasizes amassing an adequate volume of data to validate an instrument for a specific application,⁹ the educationalist approach, often linked to Messick's¹⁰ unified theory of validity, focuses on using data to support the validity of inferences about the measure. Our study takes a principally health measurement approach to validity. Our intent was to build evidence that could support the educationalist approach to validity, but to report this evidence in a language and format familiar to the health measurement field and, most important, to the end users of this information and our key stakeholders: clinicians measuring the competence of their students in clinical education settings.

METHODS

Participants

A total of 10 Canadian PT university programmes agreed to participate in this prospective study assessing the psychometrics of the ACP, which took place from March through December 2013. Ethics approval was granted either by the programme's internal review process (3 programmes) or by the university's ethics office (7 programmes). We recruited both PT students and CIs to participate in the study. All students completing an internship at a participating university during the study

Box 1 A Priori Hypotheses and Planned Analyses

	A priori hypothesis (and null hypothesis)	Analysis
Internal consistency	The ACP measure will have strong internal consistency. (H_0 : internal consistency ≤ 0.90)	Cronbach's α coefficient for each role Item-total correlation
Construct validity	Students' scores at the final point of the internship will be different (higher) than the midpoint scores. Items within the 1.0 Role of Expert will have the greatest effect size. Communication and professionalism will have smaller effect sizes. (H_0 : There will be no difference between midpoint and final point scores) Senior students will perform better than intermediate students who will perform better than junior students. However, there may be exceptions to this because each clinical internship usually represents a new practice area for a student; therefore, the profiles may not follow a linear pattern. (H_0 : There will be no difference among students at different stages.) Specific ACP items will be correlated with specific PT-CPI items hypothesized as very strong, strong, moderate, or weak. Hypothesized correlations were established by 4 NACEP members. (H_0 : There will be no or low [$r < 0.3$] correlation between ACP and CPI items.) Students who performed well or poorly on the PT-CPI will also perform well or poorly on the ACP. (H_0 : There will be no or low [$r < 0.3$] correlation between ACP and CPI total score ranks.) Progression of scores over internships for a person: The ACP will show higher scores over each sequential assessment within a student over multiple internships, showing a logical progression of scores. ACP scores for internships that occur later in the curriculum will be higher than scores for earlier internships; however, there may be exceptions to this because each clinical internship usually represents a new practice area for a student; therefore, the profiles may not follow a linear pattern.	Effect sizes Graph representing average scores per item at midpoint and final point per stage ANOVA calculations Pearson correlations Spearman correlations of the ACP and PT-CPI total score Scatterplot graph of total score rank Scatterplot graph of total score Graphing the ACP scores for each student's internship for the cohort of 14 students who appear more than once in the data set.
Practicality	CIs will report that they are able to use the ACP to assess their students and have insightful comments regarding things they liked about it and suggestions for improvement. (H_0 : There will be no or negative opinions of the ACP.) The online education module will prepare CIs to complete the ACP. (H_0 : Participants will report that they were not prepared to complete the ACP)	Descriptive statistics of the satisfaction questions at the end of the ACP. Descriptive statistics completed at the end of the education module

ACP = Canadian Physiotherapy Assessment of Clinical Performance; ANOVA = analysis of variance; PT-CPI = Physical Therapist Clinical Performance Instrument; NACEP = National Association for Clinical Education in Physiotherapy; CI = clinical instructor.

period were invited to participate; those who consented to do so could choose to participate by (1) making their clinical internship assessment forms available for the research study or (2) allowing their data to be used for the research and completing both the Physical Therapist Clinical Performance Instrument (PT-CPI)¹¹ and the ACP. Once a student had given consent, we contacted the student's CIs to invite them to participate. Participants were assigned a unique identifier to ensure that the data entered and analyzed were anonymous. These identifiers also allowed us to link student-CI pairs during an internship, identify students' university, and follow students and CIs throughout the study. The ACP was completed by the same CIs at the midpoint of the internship and at the final point. This article focuses on the ACPs completed by CIs, as opposed to those completed by students.

Data collection

Students and their CIs were asked to participate by (1) completing the online education module for the ACP; (2) providing information about the internship, including area of practice; (3) completing first the current assessment tool used in clinical education (the PT-CPI) and then the ACP at both the midpoint and the final point of the internship; and (4) answering additional validity and feasibility questions included as a component of the ACP for the pilot. The ACP was available in English and French; participants were encouraged to complete it online, but a paper copy was also available.

As part of the ACP, CIs rate students and students self-assess on each of the 21 ACP key competencies on a 10-point scale (Box 2) with six defined anchors ranging from "beginner" (1) to "with distinction" (10). From these, we calculated a role score for each of the seven roles

Box 2 Coding of the ACP Rating Scale

Beginner	Advanced Beginner	Intermediate	Advanced Intermediate	Entry-level	With Distinction
○	○	○	○	○	○
Each level was coded as:					
1	2	3	4	5	6
7	8	9	10		

on the ACP. We also calculated a total score to allow comparison between the ACP and the PT-CPI. For the purposes of this study, we measured each completed visual analogue scale on the PT-CPI, then divided the midpoint and final measures by the total line length to obtain a measure of the PT-CPI mid- and endpoint scores.

In collaboration with each academic coordinator or director of clinical education, we categorized each internship as junior, intermediate, or senior. In most cases, the first two internships of the curriculum were classified as junior internships, the last two as senior, and those in between as intermediate.

Data analyses

In this study, we focused on internal consistency, construct validity, and practicality of the ACP completed by the CI. In designing the study, we reviewed and considered standards for methodological quality (Consensus-based Standards for the selection of health Measurement Instruments, or COSMIN¹²) for the internal consistency and validity of a measure. The COSMIN is a common appraisal tool that identifies standards for evaluating the methodological quality of studies and can be used as a guide for designing or reporting on measurement properties.¹²

Internal consistency

Cronbach's α coefficient is an index of reliability that explores the variation in the construct being assessed. An acceptable level of Cronbach's α frequently cited in the literature is between 0.7¹³ and 0.90¹⁴ for scores meant to be applied at an individual level (such as our tool). For each multi-item role, we calculated inter-item correlations and used Cronbach's α to summarize the degree to which responses to the items in a given role score were consistent. We also calculated Cronbach's α with each item removed.

Construct validity

As is preferred for good studies of construct validity, we set up several a priori hypotheses and planned statistical analyses for each hypothesis (see Box 1). Our analyses focused more on the profile of scores across the roles and stages than on the amount of change in the scores. We expected the profile of midpoint ACP scores to be different from the profile of final ACP scores; therefore, we calculated effect sizes for each item using the differ-

ence between midpoint and final means over the pooled standard deviation. Effect sizes are considered to be small in the range of 0.2 and large in the range of 0.8.¹⁵ We anticipated small to medium effect sizes (0.2–0.5) for items in the Communication and Professional roles and medium to large effect sizes (0.5–0.8) for items in the Expert role.

Practicality

We used descriptive statistics to explore the usefulness of the online education module in preparing participants to use the ACP, as well as the ease of use of the ACP.

All data were analyzed using SAS (version 9.3; SAS Institute, Cary, NC). In cases in which data were missing, statistical analyses were performed with the existing data; when a value was missing for an item in an ACP role, the denominator for that role was adjusted accordingly so as to not penalise the student for the missing data. For example, if the Manager role had scores for items 4.1 and 4.3 but was missing a score for item 4.2, the scores for items 4.1 and 4.3 were added, then divided by 20 (10 per item scored) rather than 30. Total ACP scores were calculated using the same approach. When calculating a role score, we tolerated up to 50% missing data for that role; if more than 50% of items were missing (e.g., two item scores missing for a three-item role), no role score was calculated.

RESULTS**Sample description**

We analyzed 121 ACPs completed at both mid- and final points. In addition, we included 11 ACPs with only midpoint data and 5 ACPs with only final-point data (132 ACPs at midpoint and 126 at the final point, respectively) for a total of 137 ACPs. The sample of final ACPs came from 55 junior, 30 intermediate, and 41 senior students. One ACP (midpoint and final) was completed in French, and the remainder were completed in English; 87% were completed online, and the rest were completed on paper. All 10 participating universities were represented in the sample.

Of the 137 ACP entries that constituted our final data set for analysis, we had a total of 129 matched PT-CPIs (124 matched ACP and PT-CPI pairs at midpoint, and 120 matched ACP and PT-CPI pairs at the final point). Some ACPs did not have a matched PT-CPI because no

Table 1 Practice Area Characteristics for Internships with Completed ACPs

Characteristics	No. of respondents				% of total responses in the category
	Junior	Intermediate	Senior	Total	
Continuum of care					
Acute care	36	13	15	64	39
Private practice	11	10	13	34	21
Rehabilitation facility	11	7	13	31	19
Long-term care	10	—	1	11	7
Community health centre	6	1	1	8	5
Community care	2	—	2	4	2
Hospital outpatients	2	—	2	4	2
Insurance	1	—	2	3	2
Primary health care	—	2	—	2	1
Other*	2	1	1	4	2
Area of practice†					
Musculoskeletal	30	13	18	61	27
Mixed practice	24	6	13	43	19
Neuroscience	11	11	13	35	15
Cardiorespiratory	21	6	7	34	15
General rehabilitation	15	4	2	21	9
General medicine	5	3	5	13	6
Oncology	3	—	1	4	2
Critical care	—	2	1	3	1
Pain	3	—	—	3	1
Other specialty‡	1	—	4	5	2
Other area§	3	3	1	7	3
Patient age					
Mixed ages	40	14	28	82	49
66+ y	17	11	8	36	22
19–65 y	15	8	12	35	21
0–18 y	5	4	4	13	8
Population density					
Urban	41	23	39	103	71
Rural	13	7	4	24	17
Semirural	10	1	2	13	9
Remote	2	2	1	5	3

*Hospital with acute/rehab mix; paediatrics (2 responses); private not-for-profit school (1 response).

†Percentages total more than 100 because respondents could have more than one area of practice.

‡Amputees, women's health, workplace injuries, burns, rheumatology.

§Paediatrics (5 responses); rural and remote (2 responses).

ACP = Canadian Physiotherapy Assessment of Clinical Performance.

PT-CPI was completed, the PT-CPI was not returned for analysis, or the PT-CPI was incomplete.

Table 1 lists the characteristics (continuum of care, areas of practice, age groups, and settings) of the contexts in which the internships took place.

Competency (item-level) results

Descriptive statistics for the ACP items at the mid- and final points are presented in Table 2. The ACP data were normally distributed at the final point, with the exception of items 2.1, 2.2, 3.1, 3.2, 4.3, 6.1, 7.1, 7.2, and 7.3, which were moderately negatively skewed (i.e., the left tail was longer, with a greater concentration of scores on the right side of the distribution). Item 4.2 (supervising support personnel) had the highest amount of missing data (17.5%) at the final point. There was no apparent relationship between missing data and stage of training. At the final point, the internship stage was not a factor

in the missing data rate for item 4.2 (junior, 18%; intermediate, 17%; senior, 17%), but at midpoint, more intermediate students had missing data (junior, 19%; intermediate, 31%; senior, 18%). We found no indications of floor or ceiling effects in the overall data, except for item 4.2 at the midpoint (17.3%).

When analyzed separately, junior students' scores were moderately positively skewed, and senior students' scores were moderately or highly negatively skewed. That is, junior students had a higher frequency of scores at the lower end of the rating scale (beginner performance), and senior students had a higher frequency of scores at the upper end of the rating scale (entry-level performance).

Role score results

Descriptive statistics for ACP role scores at the mid- and final points, for all data and for each internship

Table 2 Overall ACP by CIs: Item-Level Descriptive Statistics at Mid- and Final Points

	Expert								Communicator			Collaborator		Manager			Advocate	Scholarly practitioner	Professional		
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1–3	7.1	7.2	7.3
M CI																					
ACP CI midpoint data (<i>n</i> = 132)																					
Mean (SD)	5.3 (2.2)	4.9 (2.2)	4.9 (2.2)	4.6 (2.2)	4.8 (2.2)	5.3 (2.3)	5.0 (2.3)	5.0 (2.5)	6.3 (2.3)	5.8 (2.4)	5.6 (2.4)	5.5 (2.4)	5.5 (2.5)	5.2 (2.5)	4.7 (2.6)	5.6 (2.4)	4.9 (2.5)	5.8 (2.4)	6.5 (2.3)	6.8 (2.3)	5.8 (2.7)
Range	1–9	1–9	1–9	1–10	1–9	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10	1–10
FC 1	4	6	8	12	8	5	8	16	2	5	5	6	9	8	18*	3	14	6	2	1	9
FC 2	9	13	14	14	18	13	14	10	6	7	7	12	11	14	8	11	12	7	4	4	7
FC 3	21	24	23	19	20	19	20	14	17	19	20	18	12	20	15	22	17	14	14	11	17
FC 4	17	13	10	17	14	16	16	17	4	8	11	8	10	15	12	9	10	8	9	6	4
FC 5	20	21	22	20	13	15	18	14	20	19	22	20	21	18	12	19	21	25	16	22	21
FC 6	16	16	17	16	26	17	16	17	10	11	10	14	16	10	4	13	9	12	8	5	5
FC 7	21	20	22	18	18	21	18	13	27	27	23	24	17	14	14	20	22	23	26	21	17
FC 8	12	12	12	10	9	16	14	15	16	16	18	16	14	19	15	13	15	14	11	12	17
FC 9	11	6	4	3	6	9	7	10	25	18	13	12	17	13	5	19	6	17	38	43	23
FC 10	0	0	0	1	0	1	1	1	5	2	3	2	2	1	1	1	1	4	3	6	3
% missing values	0.8	0.8	0.0	1.5	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	2.3	0.0	21.2	1.5	3.8	1.5	0.8	0.8	6.8
Skewness	0.01	0.04	−0.05	0.09	0.02	−0.05	0.06	−0.01	−0.40	−0.29	−0.14	−0.17	−0.19	0.05	0.12	−0.07	−0.06	−0.24	−0.51	−0.58	−0.30
Kurtosis	−0.96	−1.02	−1.06	−0.89	−1.05	−1.07	−1.01	−1.10	−0.88	−0.98	−0.99	−1.03	−0.99	−1.21	−1.27	−1.18	−1.14	−0.82	−0.88	−0.82	−1.15
F CI																					
ACP CI final-point data (<i>n</i> = 126)																					
Mean (SD)	6.7 (2.1)	6.5 (2.2)	6.5 (2.2)	6.3 (2.2)	6.4 (2.2)	6.8 (2.2)	6.6 (2.2)	6.5 (2.4)	7.5 (2.1)	7.0 (2.1)	7.0 (2.1)	7.0 (2.2)	6.7 (2.4)	6.7 (2.4)	6.1 (2.7)	7.0 (2.2)	6.2 (2.5)	7.2 (2.1)	7.4 (2.1)	7.8 (1.9)	7.1 (2.4)
Range	2–10	2–10	2–10	2–10	2–10	2–10	2–10	2–10	2–10	2–10	2–10	2–10	1–10	2–10	1–10	2–10	1–10	2–10	2–10	3–10	1–10
FC 1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	7	0	3	0	0	0	1
FC 2	1	5	3	6	6	1	3	4	1	2	1	2	4	5	6	3	9	1	1	0	3
FC 3	12	11	17	16	13	14	13	15	8	8	11	12	16	12	12	8	12	9	9	6	14
FC 4	14	10	6	5	10	7	11	12	7	6	6	9	3	10	3	8	8	4	2	4	2
FC 5	7	15	14	17	15	15	9	14	6	18	14	11	15	13	12	15	15	15	16	9	13
FC 6	18	13	15	11	13	13	18	11	11	11	13	11	10	16	11	11	16	12	6	8	7
FC 7	23	19	26	24	24	16	21	16	19	17	25	18	16	19	15	21	20	18	19	19	16
FC 8	15	20	13	18	16	23	17	19	16	23	13	20	16	10	6	13	11	17	11	8	14
FC 9	30	28	24	22	24	28	24	21	43	30	31	33	35	28	27	34	26	31	49	53	40
FC 10	5	3	6	2	4	8	8	11	15	10	12	10	7	13	5	9	5	15	10	15	10
% missing	0.8	1.6	1.6	4.0	0.8	0.8	1.6	2.4	0.0	0.8	0.0	0.0	1.6	0.0	17.5	3.2	0.8	3.2	2.4	3.2	4.8
Skewness	−0.39	−0.44	−0.32	−0.39	−0.34	−0.45	−0.36	−0.24	−0.89	−0.55	−0.48	−0.57	−0.57	−0.32	−0.41	−0.53	−0.34	−0.58	−0.85	−1.02	−0.75
Kurtosis	−0.97	−0.93	−0.95	−0.99	−0.97	−0.95	−0.92	−1.17	−0.17	−0.68	−0.76	−0.84	−0.86	−1.03	−1.04	−0.77	−0.94	−0.66	−0.36	0.08	−0.64

Note: Bolded items indicate moderate skewness; bold italic items = missing data >5%.

*Indicates a floor effect where 17.3% were scored at 1.

ACP = Canadian Physiotherapy Assessment of Clinical Performance; CI = clinical instructor; M = midpoint data; FC = frequency count; F = final point data.

Table 3 ACP by CIs: Role Score Descriptive Statistics at Mid- and Final Points

Role	1 – Expert	2 – Communicator	3 – Collaborator	4 – Manager	5 – Advocate	6 – Scholarly practitioner	7 – Professional
ACP by CI midpoint data ($n = 132$; $JR = 59$; $INT = 29$; $SR = 44$)							
No. of items	8	3	2	3	1	1	3
Cronbach's α	0.99	0.95	0.95	0.96	NA	NA	0.93
Mean (SD)	5.0 (2.2)	5.9 (2.2)	5.5 (2.4)	5.2 (2.4)	4.9 (2.5)	5.8 (2.4)	6.4 (2.3)
Range	1–9.4	1–10	1–10	1–10	1–10	1–10	1–10
% missing values	0.0	0.0	0.0	0.8	3.9	1.5	0.8
Overall skewness	0.01	–0.26	–0.20	0.03	–0.06	–0.24	–0.46
Overall kurtosis	–1.03	–0.98	–1.01	–1.25	–1.14	–0.82	–0.88
ACP by CI final point data ($n = 126$; $JR = 55$; $INT = 30$; $SR = 41$)							
No. of items	8	3	2	3	1	1	3
Cronbach's α	0.99	0.95	0.96	0.94	NA	NA	0.95
Mean (SD)	6.5 (2.1)	7.2 (2.0)	6.8 (2.3)	6.6 (2.3)	6.2 (2.5)	7.2 (2.1)	7.4 (2.0)
Range	2.3–10	2.3–10	1.5–10	2–10	1–10	2–10	2.7–10
% missing values	0.8	0.0	0.0	1.6	0.8	3.3	2.4
Overall skewness	–0.38	–0.65	–0.59	–0.37	–0.34	–0.58	–0.85
Overall kurtosis	–1.03	–0.53	–0.85	–0.98	–0.94	–0.66	–0.34

ACP = Canadian Physiotherapy Assessment of Clinical Performance; CI = clinical investigator; JR = junior internship; INT = intermediate internship; SR = senior internship; NA = not applicable.

Table 4 ACP by CIs: Effect Sizes of Mid- to Final Point Internship Data

Item	Item description	Effect size
1.4	Expert – diagnosis and prognosis	0.74
1.2	Expert – objective assessment	0.73
1.3	Expert – analysis	0.73
1.7	Expert – intervention effectiveness	0.73
1.5	Expert – intervention strategy	0.70
1.6	Expert – implements intervention	0.70
1.1	Expert – subjective assessment	0.66
3.1	Collaborator – inter-professional relationships	0.65
1.8	Expert – completes PT services	0.63
6.1, 6.2, 6.3	Scholarly practitioner	0.62
4.1	Manager – individual practice	0.62
2.3	Communicator – effective	0.61
4.3	Manager – safe and effective	0.61
4.2	Manager – supervises personnel	0.56
2.2	Communicator – information	0.55
2.1	Communicator – builds rapport	0.55
5.1	Advocate	0.51
7.3	Professional – development of PT profession	0.49
3.2	Collaborator – manages conflict	0.48
7.2	Professional – respects autonomy of client	0.45
7.1	Professional – legal/ethical requirements	0.40

Note: ACP data (ACP midpoint, $n = 132$; ACP final point, $n = 126$).

ACP = Canadian Physiotherapy Assessment of Clinical Performance;

CI = clinical instructor; PT = physiotherapy.

stage, are presented in Table 3. Missing role scores were minimal. Overall final role scores were normally distributed for Expert, Manager, and Advocate and moderately negatively skewed for Communicator, Collaborator, Scholarly Practitioner, and Professional. The highest three mean final role scores were Professional

(7.45), Scholarly Practitioner (7.24), and Communicator (7.19); the lowest was Expert (6.53). Mean role scores at the end of an internship ranged from 4.45 to 6.00 for junior students; from 6.63 to 8.28 for intermediate students; and from 8.20 to 8.86 for senior students.

Internal consistency

At the final point, Cronbach's α correlation coefficients were as follows: Expert, 0.99; Communicator, 0.95; Collaborator, 0.96; Manager, 0.94; and Professional, 0.95. Alpha coefficients were not calculated for the Advocate or Scholarly Practitioner roles because each contains only 1 item. Deleting an item from the Cronbach's α analysis minimally changed the α coefficient, which indicates that items on the ACP are consistent in assessing the same construct. Correlations of item scores to total role score were more than 0.86.

Validity

To explore the ACP's construct validity, we examined several tenets with a priori hypotheses. We expected that final ACP scores would be higher than midpoint scores and that the difference would be greatest for items in the Expert role and least for items in the Communicator and Professional roles. Effect sizes ranged from 0.40 for ACP item 7.1 (conducts self within legal/ethical requirements) to 0.74 for ACP item 1.4 (establishes a PT diagnosis and prognosis; see Table 4). The pattern of effect sizes was similar for the ACP and the PT-CPI: On the PT-CPI, the lowest effect size, 0.28, was for item 5 (legal practice), and the largest effect size, 0.74 was for PT-CPI item 11 (establishing a diagnosis).

We expected senior students to perform differently

Figure 1 ACP mean scores at mid- and final point by internship stage.

Note: Symbol depicted in lighter shade represents midpoint ACP mean; darker shade represents final point ACP mean
ACP = Canadian Physiotherapy Assessment of Clinical Performance.

than intermediate students and junior students. Figure 1 shows the average midpoint and final scores for each stage. Analysis of variance calculations by internship stage for each ACP item, as well as for ACP and PT-CPI total scores, showed significant differences at $p < 0.0001$. Post hoc analysis using a Tukey test revealed that all differences between senior and junior students, as well as those between intermediate and junior students, were significant at $p < 0.05$ for each item, but this was not the case for differences between senior and intermediate students for items in the Communicator, Collaborator, and Professional roles or for items 4.1 and 4.3 in the Manager role.

The highest correlations at the end of the internship were between the ACP Expert role and the related PT-CPI items (9, 10, 11, 12, 13, and 14), which supports the ACP's construct validity. Correlations between final ACP

and PT-CPI total scores were also very high (Pearson's $r = 0.85$, 95% CI: 0.79, 0.89; Spearman's $\rho = 0.89$, 95% CI: 0.85, 0.92), which also supports the ACP's validity.

Practicality

The 205 CIs and students who completed the ACP online education module evaluation indicated that the module took an average of 28.8 (SD 6.9) minutes to complete. More than 92% agreed or strongly agreed that the module adequately prepared them to complete the ACP, was useful, and was easy to navigate. Suggested improvements to the online education module included a pause button for the audio feed and a shorter version.

Figure 2 summarizes CIs' responses to the feasibility and satisfaction questions regarding the experience of using the ACP. Mean completion time for the ACP was

Figure 2 ACP feasibility and satisfaction scores completed by CIs ($n = 156$).

Note: 6, "The training module adequately prepared me to complete the ACP"; 5, "The Enabling Competencies (i.e., items noted as 1.2.3 or 4.3.1) helped me to understand what the item was assessing"; 4, "I understand what each item was asking me to assess"; 3, "I was able to discriminate my student's performance to grade him/her on each item with a rating scale"; 2, "The rating scale was easy to use"; 1, "The anchor descriptors for the rating scale were adequately explained so that I could easily rate the student's performance."

ACP = Canadian Physiotherapy Assessment of Clinical Performance; CIs = clinical instructors.

48.8 (SD 22.87) minutes. In response to the open-ended questions, CIs reported that they liked that the ACP seemed shorter, took less time to complete, and focused on a Canadian context; that the categories were easy to interpret; that the tool had a discrete rating scale; and that it was accessible online. Suggested improvements included a "not observed" option for items, a simpler way to save and return to an ACP not completed in one initial sitting, a spell-check option, and a simpler way to view the rating scale in a pop-up window when using the scale. Participants reported some challenges with applying the rating scale anchor descriptors to some items, such as ACP item 5.1.

DISCUSSION

The purpose of this study was to assess and report on the overall performance of the ACP. The ACP demonstrated evidence of high internal consistency and initial evidence of good construct validity; it is seen by users as a practical measure to assess and describe PT students' behaviours as observed during clinical education.

Our sample appeared mostly to be reflective of clinical education internships in Ontario and of PT practice

in Canada. Areas of practice represented in our sample were very similar to those identified in a population study of Ontario clinical education placements,¹⁶ except that our data set included fewer internships in the musculoskeletal area. Our data set was also similar to the numbers given in the Canadian Institute for Health Information's *Physiotherapists in Canada, 2010* report,¹⁷ which found that musculoskeletal and general practice were the most common practice areas and general hospital and private practice were the most common places of employment.

Final ACP data were normally distributed, with the exception of some items in the Communicator (items 2.1 and 2.2), Collaborator (items 3.1 and 3.2), Manager (item 4.3), and Professional (items 7.1, 7.2, and 7.3) roles, which were negatively skewed. These findings echo those of Proctor and colleagues'¹⁸ 7-year longitudinal analysis of the PT-CPI, published in 2010, in which students scored higher on PT-CPI items related to communication and professionalism. Higher scores on items assessing communication and professionalism may indicate that university PT programmes are admitting students

who already possess strengths in this area and therefore have less potential to show change throughout the programme.

Although the rate of missing data was minimal, item 4.2 (supervising support personnel) had the highest rate of missing data. This may have been because support personnel were not available in all clinical environments (a frequent comment in the comment box for this role) or because clinicians encouraged students to complete all components of the treatment programme with the patient themselves rather than assigning care to support personnel. Interestingly, the percentage of missing values for item 4.2 is lower for final ACPs (17.5%) than for mid-point ACPs (21.1%), which may indicate that specific opportunities to work with support personnel are targeted for the latter half of the internship. The ACP had a higher completion rate than the PT-CPI for this comparable item, which may indicate that the ACP is more relevant to PT practice. The ACP's relevance to Canadian PT practice was frequently mentioned in CIs' responses to the feasibility and satisfaction questions. Future versions of the ACP will use methods to confirm whether a rater intentionally did not respond to a certain item and, if so, require that this decision be explained before advancing to the next page, to reduce missing data and to better understand the reasons for missing data.

Internal consistency

ACP values for internal consistency met levels considered important for individual-level precision.^{13,14} Although the items on the ACP were shown to be highly related, we propose that redundancy can be tolerated in this measure because each item provides valuable feedback to students about their performance. For example, most students' ratings on items 1.1 and 1.2 will be highly correlated, but in the rare occasion on which they are not, the discrepancy will be helpful in targeting plans for improvement. In addition, in development phase 3,³ physiotherapists indicated that having separate rating scales for each item would be beneficial for the Expert role.

Validity

The ACP's validity was supported by several statistical analyses. As anticipated, effect sizes were largest for items in the Expert role (0.63–0.74), an area of students' development in which significant improvements are made during an internship, and smaller for the Professional, Advocate, and Communicator roles (0.40–0.61), for which students generally scored higher at midpoint and thus potentially had less opportunity for improvement. Effect sizes were similar for comparable ACP and PT-CPI items. When we ranked ACP effect sizes from lowest to highest, we found that the highest effect sizes on both ACP and PT-CPI were for establishing a diagnosis and prognosis, analyzing assessment findings, and performing an assessment.

The ACP was able to differentiate between junior, intermediate, and senior students, showing evidence of strong known-groups validity. Post hoc analysis showed that for some items in the Communicator, Collaborator, Manager, and Professional roles, no difference was found between intermediate and senior students. Typically, these were items for which all ratings tended to be higher than for other items; ratings on these items were high not only at the midpoint of intermediate and senior internships but also of junior internships. A study by Norman and Booth¹⁹ similarly found, after analyzing 1,460 PT-CPIs, that students were most likely to receive credit with distinction on items relating to professional behaviour (items 2 and 3) and communication (item 6). Students in Canadian PT programmes may be selected on the basis of strengths in communication and professionalism and thus have less opportunity for demonstrable growth in these areas than in other PT competencies such as assessment skills, analysis, and planning and delivering interventions. High professionalism scores have also been reported for the PT-CPI version 2006.²⁰

Although the online education module for the ACP attempts to standardise its administration and use, rater bias on the part of CIs and their inherent expectations of how intermediate and senior students perform may also have played a role in the communication and professionalism scores. It is also possible that CIs' ratings of students' communication and professionalism competencies were high because students typically emulate their intra-professional role models. Brinkman and colleagues²¹ found that medical residents were rated more highly by their physician supervisors than by nurses on several items related to communication and professionalism. A more representative view of students' abilities may be gained through ratings by people other than the CI; however, to our knowledge, there are no reports that this question has ever been studied with respect to PT. The pattern whereby some items were typically rated more highly than others has implications for how programmes may choose to determine whether students are progressing well from one clinical education experience to another. For example, students who are awarded a final rating of Advanced Intermediate for Expert competency 1.5 in an intermediate internship would likely be performing comparably to their peers but, if awarded the same rating for Professionalism competency 7.2, they would likely be lagging behind most of their peers.

Evidence of validity was also demonstrated through comparisons between the ACP and the PT-CPI. The Spearman correlation coefficient for ACP and PT-CPI total scores was 0.89, which indicates that students who scored well on the PT-CPI also received high scores on the ACP. The strongest correlations between ACP and PT-CPI items were found between the ACP's Expert role items and PT-CPI items 10 (screening), 11 (assessment), 12 (determining a diagnosis), and 13 (designs a treat-

ment plan). Although we had expected higher correlations with some items (e.g., ACP item 4.3 with PT-CPI item 1, safe practice), we found that correlations with PT-CPI items 1–5 had lower correlation coefficients—within the 0.5–0.6 range—which was likely an effect of attenuation of correlations. These PT-CPI items are generally scored high, with small variances, which can lower the correlations. In other instances, the correlations were lower than anticipated; for example, we anticipated a strong correlation between ACP item 7.2 (respects the individuality and autonomy of the client) and PT-CPI item 8 (adapts care to reflect individual differences), but in fact the Pearson correlation coefficient was 0.55 at the final point. This may be a result of the more defined rating scale in the ACP or, perhaps, of the order of items (item 8 on the PT-CPI vs. item 20 on the ACP).

Practicality

Compliance with completing education modules and the perceived usefulness of the module are important factors in minimising bias and enhancing reliability in how raters complete the measure.²² The ACP online education module received positive ratings and, on average, took less than 30 minutes to complete. The ACP measure also appears to be practical for busy front-line clinicians to use.

Methodological quality

When designing the study, we considered the COSMIN checklist.¹² All aspects of the study's design for the content and construct validity categories met the COSMIN rating of "excellent." In terms of internal consistency, only the factor analysis criterion was not met; the suitability of performing factor analysis on a measure such as ours, which has multiple domains or roles with few items in each, is debatable. Because the ACP is a profile measure that provides multiple scores across roles, factor analysis would be at a subscale level, and our subscales, other than the Expert role, have few items. In the future, with higher numbers, we intend to do confirmatory factor analysis using techniques that allow exploration of measurement models in a profile-like measure. We also assessed the ACP's measurement properties as recommended by Terwee and colleagues²³ and van Tulder and colleagues;²⁴ by this standard, the ACP's ratings were positive for measurement properties and there was strong evidence for its construct and content validity, but the level of evidence for internal consistency was "unknown" (defined as positive findings from studies of poor methodological quality).

Our study has several limitations. First, although a total of 10 universities participated in our study, 69% of the ACP data set (94 out of 137 completed ACP forms) came from only 4 of those universities. Second, CIs may have felt a need to ensure that both the ACP and

the PT-CPI assessed each student similarly, which may have contributed to the similarity of results between the two measures; completing the PT-CPI first may also have biased CIs' responses on the ACP. Third, CIs were invited to participate only if the student matched to their internship offer had already consented to participate. Therefore, some CIs who would have been willing to participate may not have been invited to do so. Last, the CIs who chose to participate in this study may be a keen, enthusiastic sample of CIs.

Future directions for the ACP include developing a more robust online platform that will allow data to be pooled from across the country to continue analyses from a broader representative sample, including diverse areas of practice as well as CIs and students who choose to complete the ACP in French. Pooling longitudinal data will also assist academic programmes by contributing to decisions about using the ACP as a summative pass–fail measure. Although using the ACP in this way was not a component of the study, having these data would be important to each programme to support its decision-making process regarding assigning grades in clinical education. In this study, the ACP demonstrated evidence of high internal consistency. Notwithstanding the challenges of exploring inter-rater and test–retest reliability in the clinical setting (e.g., the changing nature of the clinical practice environment, ensuring enough time has passed that the rater does not recall the student's performance), these two measurement properties do need to be explored. The purpose of this study was to assess and report on the ACP's overall performance. Having data from a large, accessible database will allow for the potential to establish norm references, which will help schools identify students whose performance requires attention—be it remediation or exceptional honours. Moreover, the database and its digital inputs will serve as a structure that will make it feasible to undertake reliability studies.

Last, the evidence for the ACP's reliability and validity is framed within the health measurement or classic approach to validity rather than the modern approach. Although we chose the classic approach because it would resonate with the ACP's end users, as described in the introduction section, it has the potential to compartmentalize the psychometric properties of the measure rather than view the evidence to support the inferences of the measure in a unified approach to validity.

CONCLUSIONS

On the basis of the psychometric analyses performed in this study, we found the ACP to have good internal consistency, validity, and practicality in assessing and describing PT students' behaviours in the clinical education setting. Because of these extremely promising preliminary analyses, we believe the ACP can confidently

be used to assess clinical education practice in Canada with the goal of continuing to collect data to enable additional psychometric testing of the ACP.

KEY MESSAGES

What is already known on this topic

Assessment is a valuable component of the clinical education process. A reliable, valid, and practical tool that reflects Canadian physiotherapy practice is required. A new assessment tool based on the Essential Competency Profile for Physiotherapists in Canada, the Canadian Physiotherapy Assessment of Clinical Performance (ACP), has been developed for this purpose.

What this study adds

The ACP is a reliable, valid, and practical measure to assess and describe physiotherapy students' behaviours as observed during clinical education relative to what is expected of an entry-level physiotherapist.

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APPENDIX 1

ACP description of items, rating scale and scoring

Items scored with a rating scale	<p>Expert role—focus on assessment</p> <ul style="list-style-type: none"> 1.1 Consults with the client to obtain information about his/her health, associated history, previous health interventions, and associated outcomes. 1.2 Collects assessment data relevant to the client's needs and physiotherapy practice. 1.3 Analyzes assessment findings. <p>Expert role—focus on analysis</p> <ul style="list-style-type: none"> 1.4 Establishes a physiotherapy diagnosis and prognosis. 1.5 Develops and recommends an intervention strategy. <p>Expert role—focus on intervention</p> <ul style="list-style-type: none"> 1.6 Implements intervention. 1.7 Evaluates the effectiveness of interventions. 1.8 Completes physiotherapy services. <p>Communicator role</p> <ul style="list-style-type: none"> 2.1 Develops, builds, and maintains rapport, trust, and ethical professional relationships through effective communication. 2.2 Elicits, analyzes, records, applies, conveys, and shares information. 2.3 Employs effective and appropriate verbal, nonverbal, written, and electronic communications. <p>Collaborator role</p> <ul style="list-style-type: none"> 3.1 Establishes and maintains inter-professional relationships, which foster effective client-centred collaboration. 3.2 Collaborates with others to prevent, manage, and resolve conflict. <p>Manager role</p> <ul style="list-style-type: none"> 4.1 Manages individual practice effectively. 4.2 Manages and supervises personnel involved in the delivery of physiotherapy services. 4.3 Participates in activities that contribute to safe and effective physiotherapy practice. <p>Advocate role</p> <ul style="list-style-type: none"> 5.1 Works collaboratively to identify, respond to, and promote the health needs and concerns of individual clients, populations, and communities. <p>Scholarly Practitioner role (all assessed with one rating scale)</p> <ul style="list-style-type: none"> 6.1 Uses a reflective approach to practice. 6.2 Incorporates lifelong learning and experiences into best practice. 6.3 Engages in scholarly inquiry. <p>Professional role</p> <ul style="list-style-type: none"> 7.1 Conducts self within legal/ethical requirements. 7.2 Respects the individuality and autonomy of the client. 7.3 Contributes to the development of the physiotherapy profession.
Rating scale	Discrete boxed adjectival rating scale with 6 anchors and 10 boxes
Scored	Profile score across roles

1.0 EXPERT—FOCUS ON ASSESSMENT

As experts in function and mobility, physiotherapists integrate all of the physiotherapist roles to lead in the promotion, improvement, and maintenance of the mobility, health, and well-being of Canadians.

- 1.1 Consults with the client to obtain information about his/her health, associated history, previous health interventions, and associated outcomes.
 - 1.1.1 Collects and reviews background information relevant to the client's health.
 - 1.1.2 Determines the client's expectations related to physiotherapy services.
 - 1.1.3 Collects and reviews health information about the client from other sources (e.g., other sources may include previous health records, other health care practitioners, professional colleagues, or family).
 - 1.1.4 Collects and reviews information related to the client's prior functional abilities, physical performance, and participation.
 - 1.1.5 Identifies the client's personal and environmental factors affecting his/her functional abilities, physical performance, and participation.

	Beginner		Advanced Beginner		Intermediate		Advanced Intermediate		Entry Level	With Distinction
Midterm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Final	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

- 1.2 Collects assessment data relevant to the client's needs and physiotherapy practice.
 - 1.2.1 Selects quantitative and qualitative methods and measures based on evidence-informed practice.
 - 1.2.2 Informs the client of the nature and purpose of assessment as well as any associated significant risk.
 - 1.2.3 Safely performs a physiotherapy assessment, taking into account client consent, known indications, guidelines, limitations, and risk–benefit considerations.
 - 1.2.4 Monitors the client's health status for significant changes during the course of assessment and takes appropriate actions as required.

	Beginner		Advanced Beginner		Intermediate		Advanced Intermediate		Entry Level	With Distinction
Midterm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Final	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Midterm Comments:

Final Comments:

Please check if you have significant concerns with the student's performance on these items.

☐ Midterm ☐ Final