
AWARD WINNING ORIGINAL ARTICLE

Measuring evidence-based practice knowledge, skills, attitudes, and behavior in students of manual therapy education programs: A scoping review of instruments and their measurement properties

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ABSTRACT

Objective: The purpose of this review was to identify assessment instruments and their measurement properties for assessing evidence-based practice (EBP) knowledge, skills, attitudes, and behavior among students of manual therapy education programs.

Methods: 7 electronic databases were systematically searched from inception to May 19, 2023. (MEDLINE, EMBASE, CINAHL, ERIC, EBSCO Discovery, LISA, Google Scholar.) Search terms were subject headings specific to each database (MeSH in MEDLINE) and relevant to evidence-based practice, assessment tools/instruments, and manual therapy healthcare professions. Eligible studies included students of manual therapy education programs (chiropractic, physiotherapy, occupational therapy, osteopathy) and provided evidence supporting instrument measurement properties (reliability, validity). Titles and abstracts were screened by 2 reviewers. Data on each instrument and its properties were extracted and tabulated by 2 reviewers. Instruments were compared using the Classification Rubric for EBP Assessment Tools in Education (CREATE) framework including the 5 steps in the EBP model. Joanna Briggs Institute methodology and Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist were followed.

Results: 5 studies were identified, (3 physiotherapy, 2 chiropractic) Two studies used a physiotherapy-focused modification of the Fresno test. One study presented the Knowledge of Research Evidence Competencies instrument. Two studies presented original instruments. Instruments focused on the knowledge domain and did not assess all 5 EBP model steps.

Conclusion: The current literature does not address all 5 steps of the EBP model. The identified instruments have the potential to ensure chiropractic institutions are graduating chiropractors who are highly skilled in evidence-based practice.

Key Indexing Terms: Evidence-Based Practice; Health Educators; Students; Health Occupations; Manual Therapy

J Chiropr Educ 2024;38(2):179–189 DOI 10.7899/JCE-23-28

INTRODUCTION

Since its beginnings in the early 1990s, evidence-based practice (EBP) has been adopted into professional practice in most healthcare disciplines worldwide. In research, most healthcare professions continue to survey their practitioners about their views on and abilities to perform evidence-based practice;

however, leaders in EBP report on challenges in implementation, despite some 30 years of focus.^{1–3} To better effect change in practice, there is direction for EBP training incorporation into the curriculum of healthcare professional (HCP) programs.^{2–4} Many HCP education programs have responded to this call and continue to develop their programs to include more EBP teaching. It is included in accreditation criteria and graduate competencies.^{5,6} As this change in curriculum occurs, there is a need to assess the effects of the curricular changes on students.

Instruments exist that attempt to measure change in the abilities of the EBP learner, commonly though not exclusively, in the assessment categories of EBP knowledge, skills, attitudes, and behavior (KSAB).^{7,8} KSABs are 4 of the 7 categories of educational assessment used in the Classification Rubric for EBP Assessment Tools in Education (CREATE) framework.⁹ This framework was introduced in the 2011 Sicily statement on Classification and Development of EBP Learning Assessment

This is an award-winning paper presented at the Chiropractic Educators Research Forum (CERF), June 4, 2023 conference Keeping It Real: Practice Relevant Education. The CERF Awards are funded in part by sponsorships from NCMIC, ChiroHealth USA, Clinical Compass, World Federation of Chiropractic, and Brighthall. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement, by these sponsors.

First Published Online October 23 2024

Tools, which followed the 2005 Sicily Statement on Evidence Based Practice.^{4,9} The aim of the 2011 Sicily Statement was “to provide guidance for purposeful classification and development of EBP assessment tools.”⁹

Current literature shows that the majority of testing of EBP instruments has been done with HCPs in the context of continuing education and using the domains of KSAB. To our knowledge, 10 systematic reviews exist that investigate EBP measurement instruments. The 10 reviews studied different disciplines: 4 studied practitioners of medicine or a mix of healthcare professions of which medicine was the dominant discipline,^{7,8,10,11} 2 studied nursing,^{2,12} 2 studied occupational therapy,^{13,14} 1 studied physiotherapy,¹⁵ and 1 studied rehabilitation sciences.¹⁶ Of these 10 reviews, only 2 exclusively studied student populations: Kumaravel et al studied medical students and Boruff and Harrison studied students of rehabilitation sciences.^{7,16} Albarqouni and Buchanan did not exclude student studies in their reviews; however, the group was not distinguished in discussions.^{8,13} Nine of the 10 reviews included data or referenced the 7 categories of educational assessment presented in the CREATE framework, most commonly the knowledge category.

To our knowledge, there are no reviews of EBP instruments measuring EBP KSAB in students of chiropractic, physiotherapy, occupational therapy or osteopathy. The purpose of this review was to identify assessment instruments and their measurement properties for assessing EBP KSAB among students of manual therapy (MT) education programs. This review is embedded in a larger review including practitioners. The instruments will be used to populate the CREATE framework presented in the Sicily statement on EBP assessment tools.⁴ The framework cross references 7 categories of educational assessment with the 5 steps of EBP: Ask, Search, Appraise, Integrate and Evaluate.⁴ The results of this review will inform MT educators on instruments available to evaluate EBP learning of students in their education programs.

METHODS

Inclusion Criteria

Studies fulfilled the following inclusion criteria: (1) English language; (2) published in a peer-reviewed journal; and (3) instruments including but not limited to self-reported and non-self-reported surveys and questionnaires. (4) Study population includes the following MT professions: chiropractic students or chiropractors, physiotherapy students or physiotherapists, occupational therapy students or occupational therapists, osteopathic students or osteopaths. (5) Studies have an assessment of at least 1 of these 4 EBP domains of interest: KSAB as defined in the Sicily statement and the CREATE framework.^{4,9} Studies that examine at least 1 measurement property of the instrument used including: Reliability, Validity [eg, Content, Construct, Discriminative (subset of Construct), and Responsiveness].

We performed our search on MT professions that we defined as chiropractic, physiotherapy, occupational therapy, and osteopathy, due to their similar patient base with respect to primarily musculoskeletal conditions managed. This combining of like professions is already seen in the literature in systematic reviews on EBP measurement instruments by Boruff in 2017.¹⁶ In this scoping review only the studies that reported on students of chiropractic, physiotherapy, occupational therapy, or osteopathy healthcare programs were included and reported on.

Exclusion Criteria

Studies fulfilling any of the following criteria were excluded: (1) letters, editorials, commentaries, unpublished manuscripts, dissertations, government reports, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, consensus development statements, or guideline statements; (2) study population including nurses, physicians, and other non-manual therapy healthcare professionals.

Search Strategy

The search strategy was developed in consultation with a health sciences librarian (KM) and reviewed by a second librarian using the Peer Review of Electronic Search Strategies (PRESS) Checklist.^{17,18} The following electronic databases were systematically searched from inception to May 19, 2023: MEDLINE (Ovid), EMBASE (Ovid), CINAHL (EBSCO), ERIC, EBSCO Discovery, LISA (Library Information Sciences Abstracts), and Google Scholar.

Search terms consisted of subject headings specific to each database (eg, MeSH in MEDLINE) and free text words relevant to *evidence-based practice*, *assessment tools/instruments*, and *manual therapy healthcare professions* (See Supplementary File 1 for a complete list of electronic search strategies for multiple databases). Supplementary File 1 is available as an online supplementary file accompanying this article.

The inclusion of Information Literacy (IL) instruments in our search terms for EBP measurement instruments followed the inclusion criteria of a previously published 2018 scoping review by Boruff et al, which reported on assessment of knowledge and skills in IL for rehabilitation sciences students.¹⁶ In previous works using IL as a measure of EBP, the Association of College & Research Libraries (ACRL) Information Literacy competency standards: “Determine, Access, Evaluate, Apply and Ethics” are used as equivalent to the 5 Steps of EBP.^{16,19} Although we agree that IL training fits very well into training of the first 3 steps of EBP, it is the opinion of the authors and others that this does not include vital components necessary to perform steps 4 and 5 and, therefore, IL instruments would not fully assess all 5 steps of EBP.²

The final search results were exported into EndNote x9.3.3 (Clarivate Analytics) reference manager and duplicates removed by lead investigator (LD).

Two reviewers (LD, JC) independently screened articles in 2 phases using prepiloted Excel (Microsoft Corp) spreadsheets (Supplementary File 1). Phase 1 involved screening titles and abstracts for irrelevant (IR) and possibly relevant (PR) citations. Phase 1 sheets were compared across raters, and disagreements discussed to reach consensus. The original ratings between the 2 raters were compared and agreement statistics were reported (% agreement, kappa with 95% confidence intervals). Citations rated as possibly relevant in phase 1 were reviewed using the full text article in phase 2 and ranked as relevant (R) or irrelevant (IR) in an Excel spreadsheet. Ratets met to discuss disagreements and where necessary consulted a third investigator (SHJ) to reach consensus. Again, agreement statistics were calculated and reported.

A manual citation search of included studies’ references was performed (LD, JC) from the finalized set of included studies after phase 2. Forward citation search was performed with a health sciences librarian (KM) on the included studies using Google

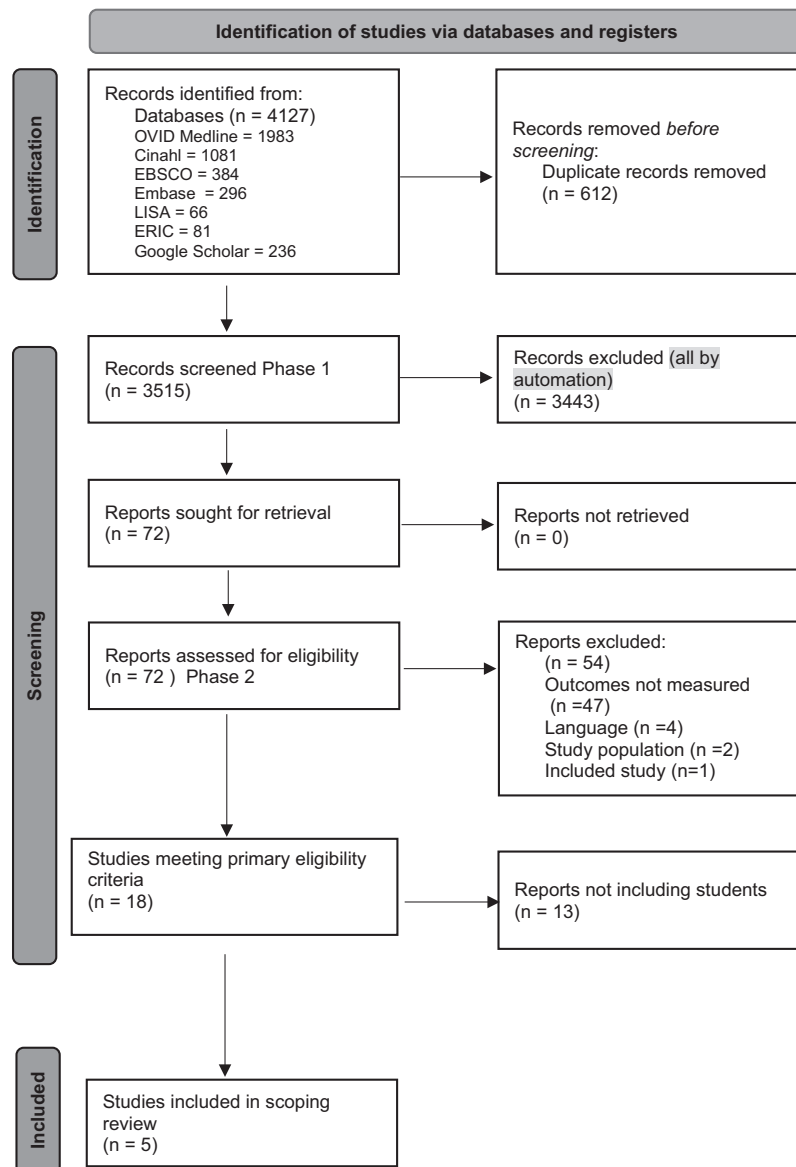


Figure 1 - PRISMA flow chart.

Scholar. Copies of EBP measurement instruments assessed in the included studies were obtained from lead authors via email correspondence where possible. No quality assessment of the selected literature was performed as it is a scoping review.²⁰

Two reviewers (LD, JK) independently extracted data from eligible sources of evidence to build evidence tables in an iterative process. A third reviewer with expertise in biostatistics and research methodology (SHJ) was consulted. Data extracted included: study location, health discipline and population, study design, instrument name and description, outcome domains of interest (EBP KSAB), and the measurement properties investigated. Additionally, data was collected on instrument administration and development: scoring points, feasibility (time required to complete and score), floor/ceiling effect, and item discrimination values.

The EBP instruments were compared in the CREATE summary table originating from the framework developed from

the Sicily statement on instruments measuring EBP.⁴ Revisions of tables consisted of consultation with third reviewer (SHJ) for consistency and accuracy of reporting validity and reliability data.

The format used to report on this review focused on the items outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).²¹

RESULTS

The results of the search are outlined in PRISMA format in Figure 1.²² We resolved any disagreements between the 2 reviewers and reached consensus without any consultation with the 3rd investigator (SHJ) for phases 1 and 2. Percentage agreement between raters for phase 1 was 87.2% (95% confidence interval [CI]: 85.9%–88.4%) with kappa 0.18 (95% CI: 0.13–0.23).

Table 1 - Included Studies

Included Studies	Study Location	Health Discipline and Population Studied	Study Design, No. of Subjects	Evidence-Based Practice Measurement Instrument
Tilson 2010 ²⁴	US	Physiotherapy Undergrad physiotherapy EBP-novice and EBP-trained students and EBP-expert faculty	Cross-sectional N = 108 N = 31 (EBP-novice PT students) N = 50 (EBP-trained PT students) N = 27 (EBP-expert PT faculty)	Modified Fresno (mFT)
Lewis et al, 2011 ²⁵	Australia	Physiotherapy Undergrad students 3rd-year physiotherapy and 3rd-year human movement programs	Cross-sectional with test-retest component N = 24 (physiotherapy: test-retest sample) N = 76 (human movement)	Knowledge of Research Evidence Competencies (K-REC)
Leo et al, 2012 ²⁶	US	Chiropractic Undergrad chiropractic students	Cross-sectional N = 267	Evidence-based practice student knowledge 40-item questionnaire.(K40-Q)
Miller et al, 2013 ²⁷	US	Physiotherapy Undergrad physiotherapy novice students	Cross-sectional with test-retest component N = 46 for inter- and intra-rater reliability N = 35 for test-retest reliability	Modified Fresno (mFT)
Tepe et al, 2015 ¹⁹	US	Chiropractic chiropractic students	Cross-sectional N = 53	Information literacy self-efficacy survey and knowledge test 25 item (IL-S/K25)

EBP: evidence-based practice; PT: physiotherapy.

Percentage agreement between raters for phase 2 was 76.8% (95% CI: 65.1%–86.1%) with kappa 0.48 (95% CI: 0.26–0.70). There were no targeted prespecified levels of agreement, but 2 reviewers were used to reduce the chance of missed studies. The higher level of agreement with the lower values of kappa, particularly for phase 1 screening, reflect what is known as the kappa paradox that occurs with uneven marginal distributions in the tables, with substantially more ratings of irrelevant (~90%) compared to possibly relevant (~10%).²³

Manual citation search and forward citation searches did not yield any new sources of evidence. An updated search was conducted to May 2023 that did not yield any new results.

General characteristics of the included studies are presented in Table 1. No studies studied EBP measurement instruments on occupational therapy or osteopathy students. Four different EBP measurement instruments were evaluated: the Modified Fresno test (mFT),^{24,27} Knowledge of Research Evidence Competencies (K-REC),²⁵ EBP student knowledge 40-item questionnaire (K40-Q),²⁶ and Information Literacy Self-efficacy survey and Knowledge tests (IL-S/K25).¹⁹ Original versions of 3 of 4 instruments were obtained: mFT,^{24,27} K-REC,²⁵ and K40-Q.²⁶ Authors of 1 study were unavailable, thus the information reported here was retrieved from the published study.¹⁹

Table 2 describes the different EBP instruments assessed in the 5 studies. The format of the mFT and K-REC is a mixture of short-answer, multiple-choice, and true or false items. The K40-Q is multiple choice and the IL-S/K25 uses a Likert scale. Domains of KSAB addressed by each instrument were identified. All 4 instruments addressed the Knowledge domain. No instruments assessed the domains of Attitudes or Behavior. Only the mFT addressed the Skills domain. Measurement properties studied were introduced.

Specific values and findings of the measurement properties assessed for each instrument are presented in Table 3. Definitions of properties of reliability and validity were consistent with the “Consensus based Standards for the selection of health status Measurement INstruments (COSMIN)” definitions.²⁸ Internal consistency was reported in 3 studies: Tilson, Leo et al, and Tepe et al.^{19,24,26} Intra- and inter-rater, and test-retest reliability was reported in 3 of 5 studies: Tilson, Lewis et al, and Miller et al.^{24,25,27} Test-retest reliability was reported by Lewis et al, Miller et al, and Tepe et al.^{19,25,27} Miller et al provided the reliability properties of standard error of measurement (SEM) and minimal detectable change of the mFT.²⁷ To allow for interpretation of these 3 reliability properties, information on scoring points of the instruments was collected where reported. Content validity was reported in 4 studies: Tilson, Lewis et al, Leo et al, and Tepe et al. Construct was reported by 2 studies: Tilson and Lewis et al.^{19,24–26}

Item discrimination values are not reported here, as it is beyond the scope of this paper. Reported times for students to complete the different instruments ranged from 10 to 41 minutes, whereas time required to score was only reported for mFT (10–20 minutes).^{24–27} Floor/ceiling effects were not identified.^{24–27}

Instruments were used to populate the Classification Rubric for EBP Assessment Tools in Education-CREATE framework presented in the Sicily statement on EBP assessment tools 2011 (Table 4).⁴ The 4 instruments assessed in our review all occupy the Knowledge assessment category of the framework. The mFT and IL-S surveys also occupy the Skills and Self-efficacy categories respectively. No instruments assess the categories of reaction to the educational experience, attitudes, behaviors, or benefits to patients. The instruments in this review all address the first 3 steps of EBP Ask, Search, and Appraise. The mFT is

Table 2 - Evidence-Based Practice Measurement Instruments, Outcome Domains (KSAB) and Measurement Properties Assessed

Instrument	Instrument Description	Outcome domains KSAB (Knowledge, Skills, Attitudes, Behavior)	
		Measurement Properties Assessed	
Modified Fresno Test (mFT), Tilson, 2010 ²⁴	14-item version of the modified Fresno: 9 short answer 5 fill in the blank Total points 232 ²⁴	Knowledge Skills ²⁴	Internal consistency ²⁴ Interrater reliability ²⁴ Intrarater reliability ²⁴ Content validity ²⁴ Construct validity (known groups) ²⁴
Modified Fresno Test (mFT), Miller et al, 2013 ²⁷	14-item version of the modified Fresno: 9 short answer 5 fill in the blank Total points 232 ²⁷	Knowledge Skills ²⁷	Feasibility ²⁴ Inter-rater reliability ²⁷ Intrarater reliability ²⁷ Test-retest reliability ²⁷ Standard error of measurement (SEM) ²⁷ Confidence in a single measure ²⁷ Minimal detectable change (MDC90) ²⁷
Knowledge of Research Evidence Competencies instrument (K-REC), Lewis et al, 2011 ²⁵	9 questions (Q8 2 parts): 2 short answer 5 multiple choice 2 true-false 1 ranking Total points 12	Knowledge	Interrater reliability Test-Retest Reliability Content validity Construct validity Feasibility
EBP Student Knowledge Questionnaire (K40-Q) Leo et al, 2012 ²⁶	40 items Multiple choice Total points: 40	Knowledge	Internal consistency Content validity
Information Literacy Self- Efficacy Survey and Knowledge Test (IL-S/K25) Tepe et al, 2015 ¹⁹	IL Self-Efficacy Survey: 25 Likert Scale questions Knowledge test: 25 multiple- choice questions	Knowledge	IL Self-Efficacy: Internal Consistency Test-retest reliability Content Validity Knowledge test 25 item: Internal Consistency Test-retest reliability Content Validity

the only instrument addressing step 4 Integrate. None of the instruments addressed the Evaluate step.

DISCUSSION

In our scoping review we identified 5 studies examining the measurement properties of 4 instruments used to evaluate EBP KSAB among MT students: the Modified Fresno test (mFT),^{24,27} Knowledge of Research Evidence Competencies (K-REC),²⁵ EBP student knowledge 40-item questionnaire (K40-Q),²⁶ and the Information Literacy Self-efficacy survey and Knowledge tests (IL-S/K25).¹⁹ Our review included instruments that had undergone some psychometric assessment. None of the studies included examined all the measurement properties we considered. To be suitable for use in education programs, instruments should have established and adequate measurement properties such as reliability including intra- and inter-rater reliability and test-retest reliability, validity (face, content, construct), and responsiveness to change. Feasibility of instrument use is also important to consider for an educational setting including time required to complete the instrument and time required to score.⁷ The 4

instruments showed combinations of acceptable internal consistency, inter- and intra-rater reliability, test-retest reliability, content (face) validity, and construct validity. In education, knowledge change is evaluated by cognitive assessment and all 4 instruments in this review used cognitive testing to assess knowledge. There was inadequate information provided in the included studies to perform qualitative analysis and this is consistent with findings by Roberge-Dao (2022) in their umbrella review on measures of EBP that states “it is unclear to what extent this guidance (COSMIN) can be applied to the range of EBP measures.”^{29,30}

K40-Q and IL-S/K25 were instruments developed for use on chiropractic students. The IL-S/K25 instrument was not obtained, and forward citation search of the authors did not find any other relevant publications. The K40-Q and the IL-S/K25 demonstrated acceptable internal consistency and face validity, and the IL-S/K25 had good test-retest reliability. The K40-Q is a multiple-choice format that without any calculations, was completed by students in 20–30 minutes.²⁶ We infer that the low demand on human and financial resources could make the administration and scoring more feasible, though this was not directly reported.

Table 3 - Summary of Measurement Properties Assessed

Measurement Properties Assessed	Modified Fresno (mFT) Tilson, 2010 ²⁴ Modified Fresno (mFT), Miller et al, 2013 ²⁷	K-REC, Lewis et al, 2011 ²⁵	EBP Student Knowledge ques- tionnaire 40 item Leo et al, 2012 ²⁶	Information Literacy (IL) Self-Efficacy Survey and Knowledge Test 25-item Tepe et al, 2015 ¹⁹
Reliability:				
Internal Consistency	Cronbach alpha = 0.78 ²⁴	—	Knowledge items: KR20 = 0.68	IL Self Efficacy: Cronbach alpha = 0.92
Cronbach alpha (ref range >0.7)				Knowledge Test-25: KR = 0.85
Kuder-Richardson (ref: 0.6–0.7)*				
Interrater ICC (ref min: 0.70 satisfactory) (95% CI where available)	Interrater: 0.91 (0.87–0.94) ²⁴	Interrater reliability: 0.97	—	—
Intrater ICC (95% CI)	Intrater 1: 0.95 (0.9–0.98) ²⁴ Intrater 2: 0.96 (0.9–0.98) ²⁴ 0.46 (0.16–0.69) ²⁷			
Test-retest Reliability				
ICC (ref min: 0.70 satisfactory) (95% CI)		0.88	—	IL Self Efficacy: 0.81 Knowledge Test-25: 0.86
SEM	11 points ²⁷	—	—	—
Confidence in a single measure	18.2 points ²⁷	—	—	—
Minimal Detectable Change	25.7 points ²⁷	—	—	—
Scoring	Total potential points: 232 ²⁷ Mean scores: 107 points (SD 14.9) for 1st test and 103 points (SD: 18.9) for the retest ²⁷	12 potential points	K40 items: 1 point per item. Potential range 0–40	IL Self Efficacy 25 item: Likert scale Knowledge Test 25 item: no scores reported.
Validity:				
Content Validity-Face validity	Yes ²⁴ Supported by consensus panel of 4 Physiotherapy (PT) Evidence-based Practice (EBP) experts ²⁴ Hypothesis confirmed ²⁴ EBP Novice = 92.8 ²⁴ EBP Trained Student = 118.5 ²⁴ EBP Expert Faculty = 149.0 ²⁴ (<i>P</i> < .0001)	Yes Supported by expert group. Hypothesis confirmed Not exposed mean = 4.2 and exposed mean = 8.4 (<i>P</i> < .0001)	Yes EBP supported by evaluation committee. —	Yes Both Instruments supported by expert panel
Construct Validity-Hypothesis testing				
Hypothesis Tested	EBP-novice PT students, EBP-trained PT students, and EBP-expert PT faculty would score differently in a successive manner on the mFT ²⁴	Better scores in EBP- exposed (3 rd -year PT) vs non (1 st -year human movement)	—	—

Table 3 - Continued.

Measurement Properties Assessed	Modified Fresno (mFT) Tilson, 2010 ²⁴ Modified Fresno (mFT), Miller et al, 2013 ²⁷	K-REC, Lewis et al, 2011 ²⁵	EBP Student Knowledge ques- tionnaire 40 item Leo et al, 2012 ²⁶	Information Literacy (IL) Self-Efficacy Survey and Knowledge Test 25-item Tepe et al, 2015 ¹⁹
Feasibility	Students given up to 60 minutes to complete ²⁴	Average completion time: 10 minutes	Average completion time: 20–30 minutes	—
Student completion time	Minutes to test completion (mean \pm standard deviation) ²⁴ Novice students: 33.2 \pm 8.7 Trained students: 34.8 \pm 10.0 Expert faculty: 40.5 \pm 15.5 Scoring: 10–15 minutes/student ²⁴ Students given up to 60 minutes to complete ²⁷ Scoring: 10–20 minutes/student ²⁷	Scoring: —	Scoring: —	—

^a K-R used where items are dichotomous.

The K-REC was developed for use with allied health professions and to date has been primarily tested in physiotherapy students. It showed good inter- and intrarater reliability, face validity, and construct validity. A second study using the K-REC by Long et al studied whether an EBP intervention led to change in a student population.³¹ They showed that the K-REC scores changed significantly before and after 2 training courses with a Cohen's effect size of 1.13 for knowledge. Effect sizes are considered as "small" (<0.2), "medium" ($0.2-0.8$), and "large" (> 0.8).^{31,32} This large effect size could be considered some evidence of responsiveness despite not being what they set out to study. Development of the K-REC was based on the Fresno test and, like the Fresno test, it starts with a clinical scenario and 9 short-answer style questions follow.²⁵ The short number of multiple choice, true/false, ranking, and short-answer questions correlated to an average completion time of 10 minutes. There was no reporting on time required to score.

The original Fresno test was included in the first systematic review on instruments for evaluation of education in EBP by Shaneyfelt in 2006.¹⁰ In the review, 43% of instruments studied were tested on students in medicine, nursing or dentistry.¹⁰ Since then, the Fresno Test has been adapted for other professions including occupational therapy, physiotherapy, and nursing.^{2,24,33} Within our included studies the mFT showed good internal consistency, inter- and intra-rater reliability, SEM, confidence in a single measure, minimal detectable change, and face and construct validity. Test-retest for the mFT reached only moderate levels as reported by Miller with the explanation that it is "...perhaps attributable to the subjects' novice level or individual motivation".²⁷ Evaluating test-retest reliability with a wider range of competencies in EBP may help address this. The mixed question type, some of which require calculation, makes administration of this test the longest of the 4 instruments at 60 minutes. Both studies on the mFT involved training of markers for up to 7 hours over several sessions.^{24,27} For use with HCPs in the field, the training of markers may be prohibitive; however, in an educational institution this may be more feasible as markers are routinely trained for diverse types of test situations.

We found no studies investigating the responsiveness of the instruments tested in MT students, although the effect sizes for the K-REC by Long et al reported above may be seen to support responsiveness.³¹ Responsiveness of an instrument would show change in scores detecting the introduction of an EBP educational intervention and would be an important statistic in assessing curricular change in an academic setting. We suggest this as a critical area of future research.

The CREATE framework includes the 5 Steps of EBP reported by the 2011 Sicily Statement: Ask, Search, Appraise, Integrate and Evaluate.⁴ The 4 instruments of our review were distributed into the CREATE framework across the first 3 steps of EBP Ask, Search and Appraise. Only 1 (mFT) was explicitly modified to assess Step 4: Integrate. This gap is consistent with previous systematic reviews on the substantially larger number of instruments developed and used with students in medicine and nursing.^{2,7,8,10,30} The first introductions of EBP teaching into HCP curricula largely occurred in the 1990s with a focus on step 3 Appraisal. Recent statements by leaders of EBP research call for the training of clinicians and clinical learners to focus on understanding the trustworthiness of evidence, evidence

Table 4 - Classification Rubric for EBP Assessment Tools in Education, CREATE FRAMEWORK (Tilson, et al, 2011⁴)

Assessment Category	Type of Assessment	Steps of EBP				Audience Characteristics
Benefits to Patients	Patient-Oriented Outcomes	—	—	—	—	—
Behaviors	Activity Monitoring	—	—	—	—	—
Skills	Performance Assessment	*mFresnoT	mFresnoT	mFresnoT	mFresnoT	<ul style="list-style-type: none"> ✓ Professional Students ◦ Clinicians ◦ Administrators ◦ Payers ◦ Policy Makers ◦ Patients ◦ Replicators ✓ Users ◦ Doers
Knowledge	Cognitive Testing	mFresnoT	mFresnoT	mFresnoT	mFresnoT	—
		**IL-Knowledge Test 25	IL-Knowledge Test 25	IL-Knowledge Test 25	IL-Knowledge Test 25	—
		***EBP student Knowledge Q40	EBP student Knowledge Q40	EBP student Knowledge Q40	EBP student Knowledge Q40	—
		****K-REC	K-REC	K-REC	K-REC	—
Self-Efficacy	Self-Report/Opinion	****IL- Self Efficacy survey	IL-Self Efficacy survey	—	—	<ul style="list-style-type: none"> ✓ Interdisciplinary ◦ Specific discipline(s) ◦ Cultural considerations
Attitudes		—	—	—	—	—
Reaction to the Educational Experience		—	—	—	—	—
Classification Rubric for EBP Assessment Tools in Education (CREATE)		ASK	SEARCH	APPRAISE	INTEGRATE	Assessment Aims <ul style="list-style-type: none"> ✓ Formative ◦ Summative

* Modified Fresno Test.

** Information Literacy Knowledge Test 25.

*** Evidence based Practice.

**** Knowledge of research evidence competencies.

***** Information Literacy Self Efficacy Survey.

summaries, and interpretation of treatment effects, over critical appraisal.¹ Researchers involved in instrument development prior to the development of the Sicily statement on EBP assessment tools recognize that "...failing to assess this knowledge (Integrate) sends an implicit message to learners that it is not important."²⁴ The Sicily statement and CREATE framework call for teaching and assessing all 5 steps of EBP.^{4,8} Future research should focus on filling this gap.

In the CREATE framework, there are 7 assessment categories.⁴ The instruments included in this review focused on 3: Self-efficacy (IL-S/K25), Skills (mFT), and Knowledge, the latter addressed by all 4 instruments using cognitive testing.^{16,26} We found no instruments that assess the other categories of the framework: Reaction to the educational experience, Attitudes, Behavior or Benefits to the patients. This is consistent with the findings of 10 existing systematic reviews on EBP instruments and the 2011 Sicily statement.

The righthand section of the CREATE framework provides additional considerations regarding the assessment of EBP in different contexts, for example clinicians versus researchers. This also applies to assessing practitioners and students using different instruments according to their role. Most instruments reported in the literature have been created for practicing professionals learning EBP as continuing education rather than students of the MT programs.^{34,35} Schools of manual therapy (physiotherapy, occupational therapy, chiropractic, and osteopathy) would benefit from more research in adaptability of existing instruments in a student population in order to assess curricular changes while implementing EBP.

The right side of the framework also suggests the possibility of interdisciplinary use of an instrument. The Sicily statement states: "...evidence-based practitioners may share more attitudes in common with other evidence-based practitioners than with non-evidence-based colleagues from their own profession. . .".⁴ It is common to see multiple HCPs assessed in a single study evaluating an EBP assessment instrument.^{11,30} Our study population group was comprised of professions with similarities in scope of practice and conditions treated, and as a result of this scoping review, the authors feel that the assessment tools could be used on chiropractic and physiotherapy. It has been suggested that using a combination of instruments developed by other fields (ie, behavioral and communication sciences) may help address all 5 steps.^{4,36} Future research assessing interdisciplinary use of outcome measures evaluating EBP is needed. The value of interprofessional learning in EBP has been recognized by several groups and sharing both EBP curricular competencies and assessments could facilitate stronger interprofessional research on EBP in healthcare.^{3,4,35,37} Future research should also be focused on this group of HCPs, as the most recent of our included studies was published in 2015, almost 10 years ago.

Strengths of this study include following the PRISMA guidance for conducting and reporting of scoping reviews. We also included a variety of manual therapy professions for increased applicability. Our scoping review had several limitations. Our exclusion criteria may have omitted outcome measures that had not reported validity or reliability. Also, the grey literature was not searched. We had a high level of disagreement in phase 1 screening and we were not able to obtain the IL-SK25 instrument. We may also have missed instruments by not including

the search term Shared Decision Making as part of step 4 in EBP.

CONCLUSIONS

The 4 identified instruments principally assessed student EBP knowledge of the KSAB domains, with some adequate reliability and validity. They all addressed steps 1 to 3 of the CREATE Framework, and 1 instrument assessed step 4. More research is needed in instruments assessing steps 4 and 5. Other disciplines, namely behavioral and communication sciences, may provide other instruments to address all 5 steps and all KSAB domains. The mFT has been well tested in the literature so far and assesses 4 steps of EBP while the K-REC appears to be a good second option for our population of interest. More assessment of instrument responsiveness is of future interest when following students' responses to curricular changes over time. Further, instruments used on practitioners may also be adaptable to a student population with adequate validity studies.

ACKNOWLEDGMENTS

The authors would like to warmly thank Dr. Hainan Yu for his expertise, patience, and guidance in the creation, software, and formatting of this study.

FUNDING AND CONFLICTS OF INTEREST

No funding was provided. The authors have no stated conflicts of interest.

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