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The 23-item Evidence Based Practice-Knowledge Attitudes and Practices (23-item EBP-KAP) Survey: Initial Validation among Health Professional Students

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Abstract

Purpose: To date, research exploring evidence-based practice (EBP) among students and early career professionals has been primarily discipline-specific and there is limited research considering the general university learning environment. When the education and application of EBP is studied, it mainly considers cognition and skills. There is a gap in the literature with respect to our understanding of EBP-related attitudes and practices alongside knowledge. This gap exists across health disciplines, as there is both limited EBP literature and a lack of generally applicable measures in this area to make transdisciplinary comparisons.

Method: Two studies, with independent samples, were conducted to psychometrically test a transdisciplinary survey of knowledge, attitudes, and practices of the use of evidence in academic and practice settings. One hundred and nine students from two health professional disciplines participated in Study 1 and 366 students from four health professional disciplines participated in Study 2. Students completed a self-administered paper-based or an online survey.

Results: Results from Study 1 directly informed Study 2. A confirmatory factor analysis confirmed in Study 2 that four subscales (knowledge, attitudes about EBP, professional practice and learning, information retrieval practices) discovered in Study 1 were a good fit to the data with an independent transdisciplinary sample. Divergent and construct validity were demonstrated through low covariances among the subscales and significant within-subject comparisons of mean differences between the subscales in both studies.

Discussion: Sufficient reliability and validity has been obtained to warrant continued use and testing. Next steps will include distributing the survey to students and healthcare professionals in other universities and other countries.

Keywords: Attitudes; Evidence-based practice; Knowledge; Practices; Scale development

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1. Introduction

In healthcare, we expect professionals to use the best available evidence to optimize patient health outcomes. Over the past 40 years, there has been both considerable growth in research evidence and limited application of research evidence.[1] In the healthcare context, failure to apply best available evidence has led to a lack of consistency, inappropriate variation in care for individuals, and negative health outcomes.[2,3] Evidence can include information from research studies, clinicians' experiential knowledge, and patient preferences and values.[3] While clinicians traditionally have little difficulty using contextually appropriate experiential knowledge and patient preferences when decision-making and clinical problem solving, their integration of research evidence into professional decision-making processes continues to be limited.

Implementation of evidence-based practice (EBP) involves taking into consideration the best available research evidence contextualized by the patients' preferences and values, professional autonomy to make evidence-based decisions, workplace culture, and environmental context (e.g., time, space, and resources) at the point of care. For at least the past 15 years, conversations about EBP have been increasing.[4] Unfortunately, discussions about evidence-based professional practice tend to take place within disciplinary silos, as well as within contextual silos such as professional training or specialized professional practices.[5] Most literature that has examined EBP with health professional students has been focused on those in medicine.[6,7] There has been limited research in nursing and occupational therapy and even less in other domain-specific areas.[8–10] Because understanding of EBP has unfolded simultaneously across varied fields of health care, but not in a transdisciplinary or integrated fashion, many approaches to measuring the uptake and outcomes of EBP are tailored to highly specific contexts.

Most instruments measuring EBP have focused on conceptual knowledge of it in medicine, with few targeting other healthcare professionals. Fewer studies still have focused on EBP-related attitudes and skills.[11] Because of this, researcher-developed surveys have proliferated but have collectively fallen short of the goal to establish and maintain evidence of validity and reliability of theoretically grounded and broadly applicable measurement tools.

Taking an evidence-based and social-cognitive approach to health professional education involves using best available evidence and empirically supported theories to deliver and enhance student understanding of the use of evidence in the academic and clinical setting. A priority outcome for education in the health professions is the extent to which a graduate will be able to integrate best available evidence into daily professional practice. Consistent with a social-cognitive approach, and specifically Ajzen's Theory of Planned Behavior,[12,13] predicting whether or not an individual will in fact engage in an intended behavioural outcome of a program (e.g., evidence-based professional practice) can be achieved by understanding: (a) what a student knows in relation to the practice of interest, (b) the extent to which a student has positive attitudes that lead to prioritizing and motivating engagement in the practice, and (c) behavioural intentions and current or previous behaviours that are part of the practice. The theory of planned behaviour is an expectancy-value model that explains voluntary behaviour. For human behaviour that a person has control over, such as the extent to which one integrates best currently available research evidence into clinical reasoning processes, one must intend to engage such a process. Within this theoretical framework, intention is predicted by attitudes one has about the intended practice as well as competency (knowledge and prior or current practices).

Self-reported knowledge, attitudes and practices (KAP) are three empirically supported constructs for understanding healthcare-professional and -student behaviour and for understanding behaviour change.[14–17] Discussing knowledge followed by attitudes followed by practices, in that order, is intentional. Health professional education programs tend to succeed in recruiting academically high-achieving students and are adept at assessing the conceptual knowledge of students. Attitudes, according to a social-cognitive approach to understanding professional practice, are as significant as knowledge when it comes to choosing to apply the knowledge in practice settings. Students can know how to critically appraise research evidence but without valuing evidence use in practice, the behavior is unlikely to continue post-graduation. Even with sufficient knowledge and positive attitudes, logistical barriers or perceived normative beliefs of a specific practice setting can limit students' ability to learn about engaging in the practice aspect of EBP during simulations and clinical placements. Given current approaches to and logistical constraints in healthcare professional education, we predict that students' self-ratings would be highest in relation to knowledge, followed by attitudes. Due to logistical constraints and current norms, on-the-ground opportunity to engage in the desired EBP behaviours is expected to be significantly lower than knowledge and

attitudes for students in health professional programs of study.

A systematic approach in the field of implementation science is proposed to improve EBP.[18] Within this approach, the mediators of behaviour and behaviour change, knowledge and attitude, have been studied amongst practicing clinicians, students, and interdisciplinary professionals.[19] In addition, these mediators have also been assessed in relation to specific health conditions or outcomes.[20] There is evidence to suggest that the mediator knowledge in and of itself does not predict behaviour.[21] However, when measuring knowledge and attitude towards EBP amongst trainees, knowledge is a greater contributor than the rest of the constructs.[20] Further support amongst these constructs is demonstrated in a recent study where researchers explored the adoption of EBP amongst both staff nurses and student nurses.[22] Adoption of EBP was significantly related to knowledge and attitude, and within the nursing students' population, knowledge was more highly correlated with EBP. Collectively, this research evidence demonstrates empirical support for knowledge, attitude, and practice influencing professional and student behaviours with respect to EBP.

When the education and application of EBP is studied, researchers mainly consider cognition and specific skills.[11] There is a gap in the literature with respect to our understanding of the attitudes and socially-situated clinical behaviours of students related to EBP. This gap extends across disciplines, as there is limited KAP-related EBP literature in this area. It is challenging to make comparisons without consistent measurement tools across the few studies that do exist.[18,23]

Although KAP surveys exist for other contexts,[5–10,24,25] they either measure KAP as not pertaining directly to EBP (e.g., KAP regarding research conduct, rather than integration of best available evidence into professional practice decisions) or they are context-specific to a point that they are not applicable to healthcare professional practice in general[19] and students more specifically.

Reliability of a measure that is used in education contexts needs to be established through demonstration of consistency across independent samples and through consistency of variances and co-variances of items within a given subscale.[23] Consistency across independent samples is important to establish trust that any observed factor structure from a given sample is not due to the uniqueness of the sample, but indeed is a consistent measure of a set of constructs across multiple, independent samples of participants.

Construct validity involves testing hypotheses about theoretically grounded patterns of relationships or differences between variables. If the constructs measured "act" the way they should according to a priori hypotheses, then evidence supports the validity (accuracy) of the measure. Construct validity for single-time point data collection can be assessed by testing a priori hypotheses about how the subscales perform in relation to each other. We hypothesize that students will have highest scores on knowledge of EBP, significantly lower scores on attitudes about EBP, and subsequently lower scores on actual EBP practices in education and in clinical placement contexts.

Divergent validity is another specific type of construct validity. Divergent validity is an assessment of the extent to which constructs are different, indicated by low covariances.[23] We hypothesize that the subscales in this measure will represent constructs that primarily contribute unique variance, and have a small amount of shared variance. We hypothesize there will be consistently small and positive covariances between subscale scores.

We conducted two independent, sequential studies to develop a measure that is applicable for transdisciplinary audiences across health professions. The objective for Study 1 was to slightly revise and evaluate a previously published 43-item survey developed to assess knowledge, attitudes, and practices related to evidence-based practice with an aim, if needed based on results, to modify the survey based on our results. Study 2 was a confirmation study with the aim to deploy the survey to an independent and broader set of health professional students and then assess the factor structure of the measurement model using confirmatory factor analysis.

A survey designed for the purposes of an educational research study in a school of medicine in Hong Kong contained many items that would assess details about knowledge, attitudes, and practices directly relevant to evidence-based practice amongst medical students.[26] This measure is a 43-item survey and some of the items, based on assessing the English translation, were long and worded for a highly specific medical education context for which the measure was designed. Johnston et al.[26] contains the full items for the original survey that we adapted. Johnson et al.'s survey was carefully developed with item-development informed by focus groups with students and the items in each subscale align with our theoretical framework. For these reasons, we saw this measure as a prime starting point for developing a measure that is possibly more parsimonious and generalizable to multiple education and practice contexts. This revised survey with simplified English language and formatting to be domain-general was distributed to assess indicators of validity and

reliability in a North American context. These were assessed by collecting data to answer the following questions: (1) What is the factorial validity of this revised measure?; (2) Do these statistically-driven scale compositions demonstrate good internal reliability?; (3) Do scores from the above-generated scale (questions1 and 2) demonstrate divergent validity by supporting the hypothesis that knowledge, attitudes, and practices should demonstrate small covariances?; (4) Do subscale scores demonstrate construct validity by testing the hypothesis that people tend to be able to report knowing what EBP is, but attitudes will be significantly less positive, and actual practices will be significantly lower than both knowledge and attitudes?; (5) Can reliability be demonstrated by achieving similar results for the four above questions across two independent studies?

2. Study 1: Exploration study

In the present study, we estimated latent measurement and observed scale statistics to assess validity and internal reliability of a survey, with items slightly revised to be transdisciplinary. A goal of the study was to find a parsimonious well-fitting measurement model to measure attitudes, knowledge, and practices related to evidence-based professional practice.

2.1. Method

2.1.1. Participants

One-hundred and nine students participated in this study. Fifty-nine students were enrolled in a nursing program and 50 were enrolled in a pharmacy program. Survey completion was anonymous. Institutional ethics approval was obtained prior to initiating the study.

2.1.2. KAB questionnaire for evidence-based practice[26]

We administered an English translation of a survey developed in Hong Kong specifically for undergraduate medical students.[26] This 43-item questionnaire was administered initially to 158 senior medical students in Hong Kong (in year five of a five-year program) for item development and pilot testing, including a focus group with 10 of these students to discuss the items in detail. Following pilot testing and needed clarification of items, the survey was administered to year 2 and 3 medical students in Hong Kong ($n = 293$) to test the factor structure through exploratory principal components analysis and assess indicators of validity and reliability. Results indicated a 26-item four-factor measure explaining 44.80% of variance with Cronbach's alpha > 0.70 for each subscale. This survey was constructed and administered in Cantonese and translated into English for publication by Johnston et al.[26] For distribution to health professional students in nursing and pharmacy, we revised the items to be domain-general. For example, we revised the item "Evidence-based medicine ignores the art of medicine" to "Evidence-based practice ignores the art of my professional work".

The Johnson et al. study only reported an exploratory model from a principal components analysis (PCA). Though there was a priori reason to create their subscales for knowledge, attitudes and practices, a confirmatory factor analysis was not reported and the proposed 26-item scale from the PCA was not subsequently tested for reliability or factorial validity through confirmatory means. For these reasons, and because we did alter the phrasing of the items from a medical to a transdisciplinary context, we used the full 43-items created by Johnston et al.[26]

2.2. Procedure

A research assistant distributed paper-based surveys during class time in a School of Nursing and a College of Pharmacy within the same post-secondary institution in North America. With informed consent obtained, participants completed the EBP-KAP survey and specified in which program they were enrolled. Survey completion took approximately 15 minutes. Survey responses were entered into IBM SPSS Statistics (version 24). Confirmatory models were fit using IBM SPSS AMOS (version 24) data analysis software and with guidance and proposed fit indices criteria from Byrne (2016).[27]

2.3. Analyses

We used confirmatory factor analysis (CFA) to assess the fit of 43 items to the knowledge, attitudes and practices subscales from the full original survey, obtained from the corresponding author.[26] IBM SPSS AMOS (version 24) software was used to conduct CFA. CFA on data with large sample size is best assessed with fit indices to assess the pre-specified model to the sample data covariance matrix.[27] Statistically significant deviation from the model is assessed with a chi-square statistic, which is highly sensitive to large sample sizes. For this reason, standardized indices of fit (effect sizes) are also reported to describe the extent to which the sample data fit the specified model.[27–29] A root mean square error of approximation (RMSEA) and its lower and upper bound of 90%

confidence intervals less than 0.10 (and preferably between 0.05 and 0.08) indicates a good fit. The standardized root mean square residual (SRMR) is an absolute measure of fit, indicating the difference between the sample covariance matrix and the model covariance matrix. A perfect fit is indicated with a score of 0 and a good fit is generally agreed to be less than 0.80.[27–29] The Tucker-Lewis Index (TLI) is also reported to compare the fit of the three measurement models. A TLI of greater than 0.95 is thought to be excellent fit, and approximately 0.90 is good fit.[29] TLI scores range from 0 to 1, with a higher score indicating higher correlations between items that load onto the same latent factor. As such, the TLI is a good indicator of internal reliability.[27] The Comparative Fit Index (CFI) accounts for sample size in its estimate of the hypothesized model as compared to the null model. A value of approximately 0.90 has been considered a well-fitting model.[27]

We also used exploratory factor analysis to inductively assess the factor structure of the original 43-item survey. Only factors with eigenvalues greater than 1 and items with factor loadings $\geq$ 0.40 (positive or negative values) were retained for any given factor. Items with extremely low factor loadings on retained factors, but high unique loading (contributing variance to the model, but not related to other items) were retained as unique identifiers. Descriptive statistics were calculated for each factor, as well as Cronbach's alpha. Cronbach's alphas were also calculated to estimate if the internal correlation statistic would increase if an item was removed. This was done for every item on their respective factors. For the retained items, item-analyses describe the extent to which respondents used the full six-point Likert scale for each item, as well as each item's normality, mean, and standard deviation. These statistics ensured that the items were not duplicates; the means and standard deviations across the items should vary. These statistics could also facilitate sample size estimation for researchers using this measure if planning a study that includes item-level analyses. Normality of item distributions was assessed by skewness and kurtosis statistics, in relation to their standard errors, the Schapiro-Wilks statistic, and visual inspection of histograms.[28] Schapiro-Wilks statistics are a correlation statistic, indicating the extent to which the observed distribution of z-scores is correlated with a perfect normal distribution.[28] Divergent construct validity was assessed through analysis of the covariances between each of the retained factors. Construct validity was also assessed through a priori hypothesis testing using analysis of variance (ANOVA) of within-subjects' subscale scores to test hypothesis that knowledge scores would be higher than attitude scores, and attitude scores would be higher than practice scores.

Table 1
Study 1 factor structure, internal reliability and item statistics.

Factor Item	α	Mean	SD	Min score	Max score	Factor loading
Knowledge	*0.84*					
1.		5.09	0.84	2	6	0.72
2.		5.04	0.92	2	6	0.53
3.		5.18	0.85	3	6	0.69
4.		5.18	0.85	3	6	0.73
5.		5.38	0.84	3	6	0.79
6.		5.39	0.76	4	6	0.78
Information Retrieval Practices	*0.78*					
7.		3.72	1.11	1	5	0.79
8.		3.59	1.11	1	5	0.89
9.		2.75	0.99	1	5	0.66
10.		1.97	0.95	1	4	0.48
Professional Practice and Learning	*0.74*					
11.		4.78	0.88	2	6	0.71
12.		4.40	0.88	2	6	0.74
13.		3.62	1.12	1	6	0.54
14.		4.56	1.09	1	6	0.77
Attitudes about EBP	*0.84*					
15.		4.96	0.79	4	6	0.63
16.		4.73	0.81	3	6	0.69
17.		2.78	1.16	1	6	0.69
18.		1.74	1.02	1	5	0.78
19.		2.49	1.09	1	5	0.71
20.		2.04	0.99	1	4	0.78
21		2.88	0.89	1	6	0.57
Unique Identifier-Accessing Secondary Sources of Evidence	*NA*					
22.		2.20	1.26	1	5	0.85
Unique Identifier-Lead EBP conversation	*NA*					
23.		2.87	1.23	1	5	0.85

Table 2
Covariances among factors, n = 103.

	Attitudes about EBP	Information Retrieval	Professional Practice & Learning
Knowledge	-0.16	0.06	0.13
Attitudes about EBP	1	-0.06	- 0.23
Information Retrieval		1	0.07

Table 3
Study 2 factor structure, internal reliability and item statistics.

Factor Item number	α	Mean	SD	Min score	Max score
Knowledge	*0.78*				
1. clear understanding of EBP		4.90	0.86	1	6
2. EBP increases efficacy		5.04	0.75	2	6
3. formulation of relevant questions		5.09	0.73	1	6
4. searching skills required		5.25	0.74	2	6
5. assess the quality of research		5.25	0.78	2	6
6. integrate with professional experience		4.68	0.89	1	6
Practice – Information Retrieval	*0.80*				
7. access evidence		4.57	1.01	1	6
8. access online sources		4.77	1.03	1	6
9. primary sources of evidence		4.02	1.12	1	6
10. systematic reviews		4.2	1.02	1	6
Professional Practice and Learning	*0.73*				
11. EBP is part of my learning		4.49	1.03	1	6
12. EBP positively affects practice		4.87	0.77	1	6
13. EBP part of teaching in practice-settings		4.23	0.95	1	6
14. doing EBP changed how I learn		4.27	1.02	2	6
Attitudes about EBP	*0.84*				
15. EBP will become standard practice		5.02	0.81	2	6
16. appreciate advantages of EBP		4.83	0.91	2	6
17. EBP disregards professional experience*		2.63	1.08	1	6
18. EBP will not last, no need to do it*		1.79	0.95	1	6
19. EBP ignores art of my work*		2.02	0.91	1	5
20. work is about helping, not statistics*		1.87	0.95	1	6
21. my experience is more important*		2.63	0.95	1	6
Unique Identifier-Accessing Secondary Sources of Evidence	*NA*				
22. guidelines, peer-presentations		4.07	1.04	1	6
Unique Identifier-Lead EBP conversation	*NA*				
23. I discuss the role of EBP at work		3.72	1.05	1	6

Note: Abbreviated wording of items provided. To obtain full copy of the survey, contact the corresponding author.
Items indicated with * are negatively worded and loaded negatively onto latent variables. They were reverse scored before calculating observed subscale scores.

Table 4
Covariances among factors, n = 366.

		Attitudes about EBP	Information Retrieval Practices	Professional Practice and Learning
Knowledge	*r*	-0.13	0.08	0.19
Attitudes about EBP	*r*	1	-0.05	-0.11
Information Retrieval Practices	*r*		1	0.17

2.4. Results and discussion

A confirmatory factor analysis of the revised 43-item survey resulted in a poor fitting model. Table 5 provides fit indices. An exploratory factor analysis using the 43 items indicated a 4-factor solution with two unique identifiers, retaining 23 items and explaining 62.13% of sample variance. The factors retained were (1) knowledge; (2) attitudes; (3) information-retrieval practices and (4) professional practice and learning. The Cronbach's alpha computed with all items retained from the factor analysis was the largest estimate (in comparison to alpha estimates if each item were deleted). This result provides further support to retain all 23 items. All items retained had a range of scores between 1 or 2 and 6 on the 6-point Likert scale. Skewness and Kurtosis statistics were less than two times their respective standard errors or less than an absolute value of 1.96, indicating approximate normality (a score of 0 is perfectly normal). Schapiro-Wilks statistics demonstrated all correlations were greater than 0.80, indicating no meaningful deviations from normality. Distributions of factor scores also did not violate normality, according to the same criteria. See Table 1 for scale statistics. A confirmatory factor analysis on the

Table 5
Model fit and model comparison for study 1 and study 2.

Model	χ^2	*df*	CFI	TLI	RMSEA [90% CI]	AIC	SRMR
Study 1 43-items* (N = 121)	1670.46	857	.547	.523	.089 [.083, .095]	1934.45	.112
Study 1 23-items* (N = 121)	532.434	290	.783	.757	.083 [.072, .095]	706.43	.106
Study 2 (N = 366)*	463.344	180	.901	.886	.066 [.058, .073]	565.34	.068

* Study 1 43-items: CFA for 43-item survey assessing EBP-related knowledge, attitudes and practices, published in Johnson et al (2003). Participants are students in nursing and pharmacy.
*Study 1 23-items: CFA for 23-item survey based on identified 4-factor model from a principal components analysis (PCA). Participants are students in nursing and pharmacy.
* Study 2: CFA for proposed factor structure of 23-item EBP-KAP survey, based on results
from Study 1. Participants are an independent sample of students in nursing, pharmacy, occupational therapy and medicine.

retained 23-item, 4-factor model, based on the exploratory factor analysis, was conducted to compare model fit statistics (See Table 5 for comparative CFA fit indices across study 1 and 2). The CFA results for the 23-item, 4 factor model demonstrated vast improvement over the 43-item model but model fit for both the 23-item and 43 item surveys were poor. The poor fit for the 23-item model was likely due to the relatively small sample size.

Covariances across all subscales were small, indicating a substantial amount of unique variance for each subscale. This provides evidence that the subscales are measuring related but different constructs (knowledge, attitudes and practices). See Table 2 for scale covariance statistics. There was a significant within-subjects main effect of the survey subscales ($F_{(3)} = 116.03$, $p < 0.001$, $Eta^2 = 0.53$) Students' scores on knowledge (M = 87.41, SD = 10.31) were significantly higher than scores on attitudes (M = 78.79, SD = 11.52), which were in turn significantly higher than scores on both information retrieval (M = 61.48, SD = 16.08) and professional practice and learning (M = 72.29, SD = 12.37) subscales. As hypothesized, the two practice subscales were not significantly different from one another.

A limitation of this study was not having extended demographic information on the participating students. A profile of demographic information of participants is useful for readers to assess the extent to which results might be transferable or generalizable to their contexts. The subsequent study, Study 2, integrated a demographics form and students completed a consent form to ensure understanding that though their information would be strictly confidential, responses were not anonymous. The factor structure reported here in Study 1 could be an anomaly of the given sample; therefore, a subsequent study was required to administer the revised survey and re-assess the factor structure in an independent sample of health professional students using confirmatory factor analysis.

3. Study 2: Confirmation study

We prospectively assessed the factor structure of the 23-item survey that resulted from Study 1 with an independent sample of students in health professions. Research questions to assess evidence of validity and reliability were: (1) Does the factor structure resulting from Study 1 fit an independent sample of data, from a broader range of health professional students?; (2)If the data fit the model (based on results from Question 1), do these scale compositions demonstrate good internal reliability?; (3) Are answers to questions 3 and 4 in Study 1 replicated in this study?

3.1. Method

3.1.1. Participants

In this study, 387 students consented to participate (nursing, n = 104; pharmacy, n = 108; medicine, n = 134; and occupational therapy, n = 41). Of those that consented to participate, 366 (94.57%) students completed the survey (nursing, n = 102; pharmacy, n = 104; medicine, n = 119; and occupational therapy, n = 41). This sample comprises 19.10% of nursing students, 29.60% of pharmacy students, 27.30% of medicine students, and 33.80% of occupational therapy students who were invited to participate. As evidenced by the online survey, those that did not complete the survey (21/387) did not proceed past the first page of the online survey. Rationale for this lack of completion was not obtained.

The average age of study 2 participants was 25 years with a standard deviation of 4.08. One hundred and

twenty-six (34.42%) students were in the first year of their program, 114 (31.14%) were in their second year, 50 (13.66%) were in their third year and 72 (19.67%) were in their fourth year of study in a health professional program. Four (1.09%) students did not respond to the demographic item asking about their year of study. Of the 366 participants, 247 (67.49%) had at least one previous university degree, 72 (19.67%) reported they did not have a university degree, and 47 (12.84%) did not respond to this demographic item. Of the 71 participants who said they did not have a previous degree, 14 provided comments explaining that they studied at university but entered their current professional program before completing a degree. It is likely that more of the 71 participants who did not hold a previous degree also attended university, but they did not report this level of detail. One-hundred sixty eight (45.90%) participants reported having prior research experience, while 88 (24.04%) reported they did not have any research experience and 110 (30.05%) of the sample did not indicate whether they had research experience.

3.1.2. The 23-item EBP-KAP survey

The 23-item survey that resulted from the EFA in study 1, containing four subscales, was used in study 2 with no changes made to factors or items. The knowledge subscale assessed the extent to which participants could identify core components of EBP. Example items in the knowledge scale include: "*The evidence-based practice process requires identification and formulation of relevant questions*" and "*Critically appraised evidence is best applied by using my professional experience and judgment*". The attitudes subscale was comprised of questions that asked participants to rate the extent to which they held both positive and negative attitudes about evidence-based practice. Example items from the attitudes scale include: "*Evidence-based practice ignores the art of my professional work*" and "*I personally appreciate the advantages of doing evidence-based practice.*" Negatively worded items were then reverse scored for subscale score calculations. There are two practice subscales: one assessed the extent to which participants engaged in information retrieval practices, and the other assessed the extent to which they engaged in evidence-based decision making and discussions in practice (or practice-related educational activity) settings. Example items include: "*I regularly access professionally-relevant evidence*"; and "*Doing evidence-based practice is a routine part of my learning*".

3.2. Procedure

Following ethical approval, all students in the four health professional programs at the same English-speaking University in North America were invited to participate and to complete the survey in person via a paper copy or online via links sent through email. Survey responses were entered into IBM SPSS Statistics (version 24) and IBM SPSS AMOS (version 24) data analysis software.

3.3. Analyses

Descriptive statistics for each item were calculated to test for ceiling or floor effects of specific items and the procedures and fit indices for CFA described in section 2.1.4 were used for this study. Internal reliability was assessed with Cronbach's alpha, construct validity of the 4 subscales was assessed by (1) inspecting the covariances among subscales, and (2) testing the hypothesis that there would be significant mean differences on the knowledge, attitudes, and practices subscale scores indicated by a within-subjects ANOVA.

3.4. Results and discussion

All items retained had a range of scores between either 1 and 6 or 2 and 6 on the 6-point Likert scale. Normality of item distributions were assessed by the same criteria used in Study 1, indicating that item responses were all normally distributed. Distributions of factor scores also did not violate normality, according to the same criteria. Cronbach's alpha computed with all items retained from the factor analysis was the largest estimate, in comparison to alpha estimates if each item were deleted. This finding provides further support to retain all 23 survey items. See Table 3 for scale statistics. Results from the CFA indicated that the factor structure is an adequate fit to the sample data (See Table 5).

Consistent with results from Study 1, the subscale scores had low covariances, indicating divergent validity (the correlations are low, indicating considerable unique variance for each of the 4 subscales) (Table 4). Consistent with Study 1, within-subjects' comparisons of the subscale-scores resulted in a significant main effect ($F_{(3)} = 131.77$, $p < 0.001$, $Eta^2 = 0.53$), with the same pattern of results. Students' scores on knowledge ($M = 83.99$, $SD = 9.15$) were significantly higher than scores on attitudes ($M = 80.82$, $SD = 11.15$), which were in turn

significantly higher than scores on both information retrieval practices (M = 73.19, SD = 13.74) and professional practice and learning (M = 74.43, SD = 11.37) subscales. The two practice subscales were not significantly different from one another.

Results from Study 2 demonstrated that the factor structure derived from Study 1 was an adequate fit for an independent sample of students from the four different health professional programs. The replication of results provided evidence of reliability and divergent and construct validity of subscales. Next steps include administering this survey and repeating the procedures of Study 2 to with the goal of demonstrating validity and reliability across more diverse contexts, including but not limited to students and professionals in other institutions and countries.

4. General discussion

The objectives of the reported studies were to adapt a 43-item survey assessing evidence-based practice related knowledge, attitudes and practices to broaden from a medical audience to a transdisciplinary one and assess latent and manifest features of the survey. In study 1, the 43-item survey demonstrated a poor fit to the measurement model. A subsequent EFA indicated a 4 factor, 23-item model that was reassessed through CFA resulted in improved fit indices but still overall poor-fit. In study 2, this 23-item scale was administered to an independent sample of health professions students and indicated acceptable model fit through CFA. Observed subscale statistics indicated a good range of scores, with normal distributions in both studies. As hypothesized, scale statistics have small covariances and significant within-subjects differences between knowledge, attitudes and practices in both studies. Replicating the second CFA results from Study 1 in an independent subsequent sample in Study 2 provided supporting evidence to infer reliable and valid subscales. However, validity and reliability cannot be proven as they are only demonstrated for specific contexts and populations over time.

Educating healthcare providers at all levels of study is required to achieve the goal of EBP.[30] Appreciating EBP similarities and differences amongst students across health professions provide us with data to highlight educational needs and to advance curriculum initiatives. Measurement tools, such as the survey assessed here, can be used to clarify what impact EBP knowledge, attitudes, and practices (KAP) has on early career professional behaviours and subsequent impact on patient and student outcomes. Research using this survey, focused on key features of the core components of EBP, will lead to results generated across contexts that are comparable. Consistent measurement with demonstrated reliability and validity will deepen our understanding of what influences EBP and how to both teach and implement it over time, from professional preparation through to practice. Another use of such a measurement tool would be in assessing the impacts of specific instructional strategies to build EBP capacity. If a professional development seminar is designed, for instance, for a group of nurses and is seen to be highly effective at improving knowledge, attitudes and practices around EBP, these findings about instructional design for professional development could be shared with other professional groups holding the same goal to shift culture toward one that integrates evidence into health professionals' everyday decision-making and behaviour. Findings from our survey make clear that research cannot assume that knowledge and attitudes are proxy measures for practices. We need measurement tools, such as the 23-item EBP-KAP, that assesses these constructs at once.

Knowledge translation is complex and contextually situated. Development of this 23-item EBP-KAP survey contributes to stakeholders involved in both classroom and clinical instruction, and in curriculum development for healthcare disciplines and interprofessional collaboration. Stakeholders include university professors, clinical instructors, pre-licensure students, clinicians, curricula developers, and policy makers. The knowledge generated from this study will enable us to enhance curriculum development of both the individual included disciplines and all four disciplines interprofessionally. In addition, it will provide us with data that will contribute to our further focus on early-career professionals, their contributions to the health care system, and the supports required to ensure that they can practice in an evidence-informed environment and the continued use of the skills obtained from their student experiences.

A limitation of this measure's early demonstration of reliability and validity is lack of an outcome variable, such as actual practice upon graduation, to assess the predictive validity of this survey. This is highly recommended for future research addressing education utility. Despite the promising reliability and validity of this instrument for assessing KAP for EBP, we will continue the testing and reporting of same across professions that include a culture of, or a desired culture of, EBP.

Disclosure

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