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ORIGINAL ARTICLE

Use of the Evidence-Based practice Attitude and utilization SurvEy to determine the use of evidence-based practice by chiropractic students

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ABSTRACT

Objective: To assess the attitudes, skills, training, knowledge, barriers, facilitators and use of evidence-based practice (EBP) by chiropractic students and determine the variables important to perceptions of EBP.

Methods: We utilized the Evidence-Based practice Attitude and utilization SurvEy (EBASE) to achieve our stated objectives. In addition to descriptive statistics, we utilized a generalized linear model to determine the most highly significant items of the EBASE instrument that contributed towards overall EBP perception.

Results: A convenience sample of 163 chiropractic students comprised our study population. The majority of students (74%) were 20–29 years of age and achieved a baccalaureate degree or higher (80%) prior to chiropractic matriculation. The respondents indicated positive overall attitude and support of EBP but felt were inadequately trained in EBP and had poor skills in conducting clinical research and systematic reviews. Indicated barriers to EBP were lack of time and lack of clinical evidence for relevant studies. Access to the internet and databases, and ability to download full manuscripts were facilitators to the use of EBP. Generalized linear modelling identified the following as having a significant effect on overall positive EBP perception: confidence in applying research evidence to clinical practice, a lack of interest in EBP, membership in a professional association, quarter of study at institution, and access to tools to critically appraise existing research.

Conclusion: Our use of the EBASE questionnaire identified the attitudes, barriers and facilitators to the uptake of EBP by chiropractic students and those variables that contributed to overall EBP perception.

Key Indexing Terms: Chiropractic; Education; Students; Evidence-Based Practice; EBASE

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INTRODUCTION

In the early 1990s, Guyatt et al[1] argued that medical education and practice should emphasize evidence from clinical research and mitigate intuition, unsystematic clinical experience, and pathophysiologic rationale and as such, the modern era of evidence-based medicine (EBM) was born. Sacket et al[2] defined EBM as clinical decision-making that integrates clinical expertise with the best available external clinical evidence from systematic research while respecting a patient's rights and preferences. Since the early 1990s, EBM has become the mantra and dominant paradigm of medical care and its application—evidence-based practice (EBP). The principles and practice of EBM have been universally adopted by all healthcare professions from nursing,[3] dentistry,[4] pharmacy,[5] physical therapy,[6] and alternative therapies such as chiropractic.[7] As a natural consequence, the principles of EBP have become the focus of educators in all healthcare professions. Healthcare providers as effective practitioners should make informed clinical decisions about patient care. Therefore, the basic skills of EBP should be taught as an integral part of the training of all healthcare professionals early in and throughout their educational curriculum.[8]

In chiropractic, such sentiments were echoed by Bussières et al[9] based on their scoping review on the current state of knowledge on EBP, research utilization and knowledge translation. As it pertains to EBP, Bussières et al[9] found that while chiropractors held positive attitudes towards EBP and were interested in improving their EBP skills, the application of EBP in clinical practice appeared to be suboptimal. Thematic analysis further revealed that as it relates to the attitudes towards and beliefs about EBP, chiropractors have varying perspectives due to diverging attitudes about chiropractic philosophy and scope of practice. The authors supported the development of national standards of care protocol based on EBP guidelines. In terms of knowledge translation, a number of knowledge practice gaps, barriers and facilitators to knowledge

use and selection, tailoring, and implementation of interventions were identified. Overall, Bussières et al[9] found that the use of EBP and practice guideline adherence varied widely in the chiropractic profession. For chiropractors to routinely apply evidence into clinical practice and improve patient care, Bussières et al[9] commented that educational strategies must be developed and aimed at practicing chiropractors and chiropractic students.

To contribute to the development, implementation and evaluation of an effective healthcare curriculum that incorporates the concepts and principles of EBP in chiropractic, we surveyed chiropractic students at 1 chiropractic institution using an adapted version of the Evidence-Based practice Attitude and utilization SurvEy (EBASE), a survey instrument that was originally intended for alternative medicine practitioners.[10] Specifically, we wanted to examine the attitudes, skills, training, knowledge, barriers, facilitators and use of EBP among chiropractic students and what variables contribute to their overall EBP perception.

METHODS

This study was approved by the institutional review board of Life West College of Chiropractic. With permission, we adapted the EBASE questionnaire by Leach and Gillham[10] to examine the attitudes, skills, training, knowledge, barriers, facilitators and use of EBP by chiropractic students (Supplementary File). The 84-item questionnaire was tailored specifically for alternative medicine practitioners and therefore necessitated adaptation (albeit minor) for chiropractic students and implemented as an online questionnaire from October 2017 to November 2017. The EBASE questionnaire has been demonstrated to have good internal consistency (Cronbach alpha = 0.84) and acceptable test-retest reliability (Intraclass Correlation Coefficient = 0.578–0.986). The instrument also demonstrated good content validity (Content Validity Index = 0.899), and adequately measured practitioner skill and utilization of EBP when compared with the evidence-based practice questionnaire (EBPQ).[10] The instrument was piloted with 10 chiropractic students prior to their full implementation to identify potential problems associated with the survey and the feasibility of full implementation at 1 chiropractic teaching institution.

The EBASE questionnaire was adapted for chiropractic students rather than for chiropractors. In terms of wording of certain items in the survey pertaining to clinical practice, the wording was modified to "intended practice." The output for this study was generated using Qualtrics software, Version 1 of Qualtrics (Copyright © 2005 Qualtrics). Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA.[11] Qualtrics has response requirements and validation functions (ie, force response and content validation) which were implemented in this study. In addition to obtaining from the respondents their socio-demographic data (ie, age group and sex), year of study and intended practice characteristics (ie, solo practice, urban setting, primary and adjunctive modality of care), we added a question asking the respondents if they were or were not a student intern caring for patients in the institution's outpatient clinic. In section B EBP Skills, the item "retrieving evidence" was not included in the survey.

Since perceptions and attitudes towards EBP may in part be a natural outcome/response from the comprehensive educational and clinical experience of healthcare providers within their respective learning institutions,[12–14] we wanted to determine what response variables in the EBASE questionnaire significantly contributed to overall EBP perception. In addition to descriptive statistics (ie, frequencies, means, proportions), we constructed a metric that represents overall EBP perception (ie, the numeric sum or average of the responses to the items pertaining to the Attitudes Towards EBP perception) to determine the variables of interest from the EBASE questionnaire that contributed significantly to overall EBP perception. Since the responses to the EBASE items were on an ordinal scale of "Strongly Disagree" to "Strongly Agree", we assigned numerical values to these responses and then summed or averaged the scored responses. Note that the scoring of 2 items (ie, "The adoption of evidence-based practice will place an unreasonable demand on my practice." and "There is currently a lack of evidence from clinical trials to support most of the treatments I will use in my practice.") were reversed since a "Strongly Agree" response was a negative perception of EBP. A predictive modelling analysis was performed on Overall EBP Perception using the responses to items in Section A - Attitudes towards EBP of the EBASE questionnaire. The motivation for the construction of an Overall EBP Perception metric was rooted in our understanding that all 9 of these items collectively represent a single subject's perception of EBP. There are many ways to combine such variables using dimensionality reduction techniques, but our construction was best for the following reasons: (1) Increases in each of these variables denote an improved perception of EBP, (2) Summing these variables together preserves the same scale as item 1, meaning that a 1 unit increase in the summed variable means that a subject responded 1 unit higher for a single question, and (3) The combination of these variables using some variation of principal component or factor analysis requires some sacrifice in the explained variation of the newly derived response variable and also requires a more complex interpretation of how each of the original variables correlates with the newly derived metric.

RESULTS

Description of Student Respondents

A convenience sample of 172 respondents initially comprised our study population. After data cleaning, the sample size was 163. The socio-demographic data and other practitioner characteristics are summarized in Table 1. The majority of respondents were males ($n = 97$; 60%) more than females ($n = 65$; 39%) with 1 responder identifying as "Other." The majority ($n = 120$; 74%) were between the age of 20–29 years. The respondents were also highly educated with over 80% having a baccalaureate degree or higher prior to their chiropractic matriculation. The majority ($n = 113$; 69%) indicated as not intending to practice another type of complementary and alternative medicine (CAM) therapy. Although the majority ($n = 120$; 74%) indicated as having no experience with other types of CAM therapies, 21 (13%) indicated less

Table 1 - Descriptive Statistics of Practitioner Socio-Demographic and Other Practitioner Characteristics

Age	19 y or under $n = 0$; 0%	20–29 y $n = 120$; 74%	30–39 y $n = 32$; 20%	40–49 y $n = 11$; 6%	50–59 y	60–69 y $n = 0$; 0%
Quarter of study	Quarters 1–4 $n = 56$; 34%	Quarters 5–8 $n = 27$	Quarters 9–12 $n = 51$	Quarter 13 or more $n = 29$		
Gender	Male ($n = 97$; 60%)	Female ($n = 65$; 39%)	Other ($n = 1$; <1%)			
Educational level prior to chiropractic matriculation	Some college $n = 9$; 5%	2-y college certificate $n = 20$; 12%	Bachelor's degree $n = 125$; 77%	Master's degree $n = 8$; 5%	PhD $n = 0$; 0%	
Intended CAM practice in addition to Chiropractic	Naturopathic medicine $n = 12$; 7%	Western herbal medicine $n = 3$; 2%	Homeopathic medicine $n = 0$; 0%			
	Traditional Chinese medicine/acupuncture $n = 4$; 2%	Massage $n = 24$; 15%	No intention to train in another CAM therapy $n = 113$; 69%			
Years practiced in the above-mentioned area of CAM	<1 y $n = 21$; 13%	1–5 y $n = 10$; 6%	6–10 y $n = 2$; 1%	11–15 y $n = 3$; 2%	16+ y $n = 1$; <1%	Never Practiced above CAM therapies $n = 120$; 74%
Intended practice setting	Solo $n = 53$; 32%	With a partner $n = 55$; 34%	With CAM professionals $n = 23$; 14%			
	With medical professionals $n = 1$; <1%	Combination CAM and medical professionals $n = 26$; 16%	Within an institution such as a hospital $n = 3$; 2%			
Professional affiliation	No affiliation ($n = 91$; 53%)	Student ICPA ($n = 28$; 16%)	Student ICA ($n = 42$; 24%	Student ACA ($n = 16$; 9%)		
Intended primary modality for chiropractic practice	Spinal adjustment/manipulation $n = 158$; 97%	Nutrition $n = 1$; <1%	Massage $n = 2$; 1%	Acupuncture $n = 0$; 0%		
	Herbal remedies $n = 1$; <1%	Homeopathic remedies $n = 0$; 0%	Naturopathic remedies $n = 0$; 0%	Other $n = 1$; <1%		
Intended adjunctive therapy for chiropractic practice	Spinal adjustment/manipulation $n = 52$; 32%	Nutrition $n = 53$; 33%	Massage $n = 20$; 12%	Acupuncture $n = 3$; 2%		
	Herbal remedies $n = 1$; <1%	Homeopathic remedies $n = 3$; 2%	Naturopathic remedies $n = 4$; 2%	Other $n = 26$; 16%		
Intended country of Practice	United States ($n = 132$; 81%)	Canada ($n = 15$; 9%)	Not Indicated ($n = 16$; 10%)			

CAM: complementary and alternative medicine, ICPA: International Chiropractic Pediatric Association, ICA: International Chiropractic Association, ACA: American Chiropractic Association.

than 1 year of practice experience with another type of CAM therapy. In terms of their intended practice environment, the majority indicated practicing with a partner ($n = 55$; 34%) followed by solo practice ($n = 53$; 32%), with CAM and medical professionals ($n = 26$; 16%) and with other CAM professionals ($n = 23$; 14%). In terms of affiliation/membership with a professional organization, 53% ($n = 91$) indicated no affiliation. Twenty-four percent ($n = 42$) indicated membership with the Student International Chiropractors Association followed by membership with the International Chiropractic Pediatrics Association ($n = 28$; 16%) and 9% ($n = 16$) with the Student American Chiropractic Association. These responses were not mutually exclusive.

The majority (97%) indicated the use of spinal adjusting/spinal manipulation as their primary mode of delivering care while adjunctive therapies were indicated as nutrition (33%), spinal adjusting/manipulation (32%), and massage (12%). Most students intended to practice in the United

States ($n = 132$; 81%) with the remainder indicating intended practices in Canada ($n = 15$; 9%) and 16 (10%) as not indicated (Table 1).

Attitude Towards EBP

Responses to the EBASE Part A Attitude towards EBP are summarized in Table 2. The majority of respondents provided a positive attitude towards EBP (ie, strongly agreed/agreed that EBP is necessary in chiropractic practice, interest in improving skills necessary to incorporate EBP, EBP will improve quality of patient care). The majority strongly disagreed/disagreed that EBP placed an unreasonable demand on their practice but most strongly agreed/agreed that there is currently a lack of evidence from clinical trials to support their chiropractic practice.

EBP Skills

Responses to the EBASE Part B EBP Skills are summarized in Table 2. Only 2 items (ie, locating professional literature such as journal articles and online database searching) were indicated by the majority of respondents as having advanced skills, 4 items (ie, identifying answerable clinical questions, synthesis of research evidence, conducting and using findings from systematic reviews) were identified by the majority as having poor skills.

EBP Training/Education

Responses to the EBASE Part C EBP Training/Education are summarized in Table 2. The majority of respondents indicated that they were confident in applying research evidence to clinical practice and in critical thinking or analysis. The majority indicated also indicated that they were not adequately trained in EBP or in conducting clinical research and performing systematic reviews of the literature.

EBP Use

Responses to the EBASE Part D EBP Use are summarized in Table 2. Most respondents indicated reading 1–5 articles of professional literature and clinical research related to chiropractic practice. The majority of respondents also indicated as having performed at least 1–5 occurrences with using professional literature or research findings to prepare for clinical decision, used an online search engine and database, 6–10 occurrences with consulting a colleague or professor to assist their clinical decision-making and the majority (47%) indicated as never having referred to magazines, layperson/self-help books, or nongovernment/noneducation institution websites to assist their clinical decision-making. The majority (35%) indicated that 1%–25% of their student clinical experience was based on clinical research evidence followed by 31% of respondents indicating that none of their student clinical experience was based on clinical research evidence.

When asked to rank order (ie, most frequently used = 1; least frequently used = 11) a number of sources of information to inform the basis of your decision, the students indicated the following from most frequently used to least frequently used: consulting fellow practitioners or experts; clinical practice guidelines; traditional knowledge; textbooks; personal intuition; trial and error; patient preference; published experimental/laboratory evidence (ie, animal or test tube studies); personal preference; published clinical evidence (ie, clinical trials).

Barriers to EBP Uptake

Responses to the EBASE Part E Barriers to EBP uptake are summarized in Table 2. When inquired about the barriers (moderate-major barrier) or not a barrier (no barrier or minor barrier), almost equal proportions (with slight favor towards a barrier) of the respondents identified lack of time and lack of clinical evidence in complementary and alternative medicine. The majority of respondents indicated as a barrier the following: lack of resources (ie, access to a computer, the internet or online databases), insufficient skills for locating research, insufficient skills for interpreting research, insufficient skills to critically appraise/evaluate the literature, insufficient skills to apply research findings to clinical practice, lack of incentive to participate in evidence-based practice, lack of interest in evidence-based practice, lack of relevance to CAM practice, lack of colleague support for evidence-based practice, lack of industry support for evidence-based practice and patient preference for treatment.

Facilitators to Use of EBP

Responses to the EBASE Part F Facilitators to EBP Use are summarized in Table 2. The usefulness of a number of strategies towards EBP were indicated by the majority of respondents as moderately useful or very useful. These were: access to the Internet in the workplace/practice (93%), access to free online databases at the college (ie, PubMed and Index to Chiropractic Literature) (98%), free access to online databases that usually require license fees (ie, CINAHL and AMED) (93%), the ability to download full-text/full-length journal articles (9%), access to online education materials related to evidence-based practice (95%), access to tools used to assist the critical appraisal/evaluation of research evidence (90%), access to critically appraised topics relevant to chiropractic field (91%), access to critical reviews of research evidence relevant to the practice of chiropractic (93%), access to research rating tools that facilitate critical appraisal of single research papers (80%), and access to online tools that assist you to conduct your own critical appraisals of multiple (81%).

The kernel density estimation (KDE) of overall EBP perception is provided in Figure 1. KDE is a nonparametric estimation technique for probability density functions. We use KDE plot here to identify that the distribution of overall perception of EBP is nonnegative and left skewed. This provides preliminary justification to consider gamma generalized linear models (GLMs) alongside Gaussian GLMs. Although not shown, we performed residual diagnostics plots to inspect the model residual for deviations from common assumptions regarding normality, heteroscedasticity, and high leverage behavior in the residuals. We found no clear violation of homoscedasticity. The assumptions of residual diagnostics assessment for the fit of our final model (ie, Gamma GLM with log link) were adequately met. The negatively skewed or left-skewed distribution of our response variable (Fig. 1) was an indication that the average responses to EBP perception questions were higher than the "neutral" score of 27.0 points. The average "Overall EBP Perception" score was 34.5, which

Table 2 - Summary Statistics of the EBASE Responses

Part A: Attitude Towards EBP	n	Strongly Disagree/ Disagree	Neither Disagree or Agree	Strongly Agree/ Agree
Evidence-based practice is necessary in the practice of chiropractic	163	4 (2%)	8 (5%)	151 (93%)
Professional literature (ie, journals & textbooks) and research findings will be useful in my day-to-day practice	162	3 (2%)	8 (5%)	151 (93%)
I am interested in learning or improving the skills necessary to incorporate evidence-based practice into my practice	162	4 (2%)	21 (13%)	137 (85%)
Evidence-based practice will improve the quality of my patient's care	163	7 (4%)	21 (13%)	135 (83%)
Evidence-based practice will assist me in making decisions about patient care	163	5 (3%)	13; 8%	145 (89%)
Evidence-based practice takes into account my clinical experience when making clinical decisions	163	13 (8%)	26 (16%)	124 (76%)
Evidence-based practice takes into account a patient's preference for treatment	163	42 (26%)	50 (31%)	71 (43%)
The adoption of evidence-based practice will place an unreasonable demand on my practice	163	72 (44%)	68 (42%)	23 (14%)
There is currently a lack of evidence from clinical trials to support most of the treatments I will use in my practice	162	40 (25%)	58 (36%)	64 (39%)

Part B: EBP Skills	n	(Poor) 1–2	3	4–5 (Advanced)
Identifying knowledge gaps	162	26 (16%)	76 (47%)	60 (37%)
Identify answerable clinical questions	162	36 (22%)	74 (46%)	52 (32%)
Locating professional literature (ie, journal articles)	163	43 (26%)	56 (34%)	64 (40%)
Online database searching (ie, Medline)	163	36 (22%)	46 (28%)	81 (50%)
Critical appraisal of evidence	161	54 (34%)	66 (41%)	41 (25%)
Synthesis of research evidence	161	61 (38%)	55 (34%)	45 (28%)
Applying research evidence to patient cases	161	44 (27%)	63 (39%)	54 (34%)
Sharing evidence with colleagues	163	51 (31%)	57 (35%)	55 (34%)
Conducting clinical research (ie, clinical trials)	163	114 (70%)	28 (17%)	21 (13%)
Using findings from clinical research	161	55 (34%)	63 (39%)	43 (27%)
Conducting systematic reviews	160	100 (63%)	44 (27%)	16 (10%)
Using findings from systematic reviews	159	70 (44%)	59 (37%)	30 (19%)

Part C: EBP Training and Education	n	Strongly Disagree/ Disagree	Neither Disagree or Agree	Strongly Agree/ Agree
I feel adequately trained in evidence-based practice/ evidence-based medicine	161	72 (45%)	50 (31%)	39 (24%)
I am confident in applying research evidence to clinical practice	162	42 (26%)	47 (29%)	73 (45%)
I am confident in conducting clinical research (ie, clinical trials)	161	93 (58%)	41 (25%)	27 (17%)
I am confident in conducting systematic reviews or meta-analysis (ie, statistical analysis of data combined from 2 or more studies)	160	100 (63%)	37 (23%)	23 (14%)
I am confident in critical thinking/critical analysis	163	17 (11%)	41 (25%)	105 (64%)

Part D: EBP Use	n	0 Articles	1–5 Articles	6–10 Articles	11–15 Articles	16+ Articles
I have read/reviewed professional literature (ie, professional journals & textbooks) related to the practice of chiropractic	95	21 (22%)	39 (41%)	16 (17%)	10 (11%)	9 (9%)

Table 2 - Continued.

Part D: EBP Use	n	0 Articles	1–5 Articles	6–10 Articles	11–15 Articles	16+ Articles
I have read/reviewed clinical research findings related to the practice of chiropractic	95	28 (29%)	35 (37%)	17 (18%)	7 (7%)	8 (8%)

		Never	1–5 Occurrences	6–10 Occurrences	11–15 Occurrences	16+ Occurrences
I have used professional literature or research findings to prepare for clinical decision making in the practice of chiropractic	79	17 (22%)	41(52%)	14 (18%)	3 (4%)	4 (5%)
I have used professional literature or research findings to change my clinical practice	41	31 (76%)	0 (0%)	6 (15%)	3 (7%)	1 (2%)
I have used an online database (ie, CINAHL, MEDLINE) to search for practice related literature or research	79	9 (11%)	50 (63%)	9 (11%)	5 (6%)	6 (8%)
I have used an online search engine (ie, Google) to search for practice-related literature or research	79	4 (5%)	29 (37%)	21 (27%)	9 (11%)	16 (20%)
I have consulted a colleague or professor to assist my clinical decision-making	78	1 (1%)	26 (33%)	28 (35%)	9 (12%)	14 (18%)
I have referred to magazines, layperson/self-help books, or nongovernment/noneducation institution websites to assist my clinical decision-making	68	32 (47%)	18 (26%)	12 (18%)	4 (6%)	2 (3%)

	n	0%	1%–25%	26%–50%	51%–75%	76%–99%	100%
What percentage of your student clinical experience do you estimate is based on clinical research evidence (ie, evidence from clinical trials)?	95	29 (31%)	33 (35%)	16 (17%)	14 (15%)	3 (3%)	0 (0%)
Rank order of sources of information to inform the basis of your clinical decision (please rank the items from 1 to 11 with 1 = the most frequently used source of information; 11 = the least frequently used source of information)	70	In terms of rank order from most frequent to least frequently used source of information: consulting fellow practitioners or experts; clinical practice guidelines; traditional knowledge; textbooks; personal intuition; trial and error; patient preference; published experimental/laboratory evidence (ie, animal or test tube studies); personal preference; published clinical evidence (ie, clinical trials); other					

Part E: Barrier to Evidence-Based Practice	n	Not a Barrier	Minor Barrier	Moderate Barrier	Major Barrier
Lack of time	162	21 (13%)	54 (33%)	54 (33%)	33 (20%)
Lack of resources (ie, access to a computer, the internet or online databases)	162	70 (43%)	52 (32%)	29 (18%)	11 (7%)
Lack of clinical evidence in complementary and alternative medicine	163	19 (12%)	59 (36%)	60 (37%)	25 (15%)
Insufficient skills for locating research	163	47 (29%)	72 (44%)	29 (18%)	15 (9%)
Insufficient skills for interpreting research	163	42 (26%)	68 (42%)	32 (20%)	21 (13%)
Insufficient skills to critically appraise/evaluate the literature	163	36 (22%)	69 (42%)	40 (25%)	18 (11%)
Insufficient skills to apply research findings to clinical practice	163	39 (24%)	76 (47%)	33 (20%)	15 (9%)

Table 2 - Continued.

Part E: Barrier to Evidence-Based Practice	n	Not a Barrier	Minor Barrier	Moderate Barrier	Major Barrier
Lack of incentive to participate in evidence-based practice	162	49 (30%)	58 (36%)	38 (23%)	17 (10%)
Lack of interest in evidence-based practice	163	74 (45%)	49 (30%)	26 (16%)	14 (9%)
Lack of relevance to complementary and alternative medicine (CAM) practice	161	60 (37%)	66 (41%)	29 (18%)	6 (4%)
Lack of colleague support for evidence-based practice	162	60 (37%)	56 (35%)	33 (20%)	13 (8%)
Lack of industry support for evidence-based practice	162	43 (27%)	55 (34%)	46 (28%)	18 (11%)
Patient preference for treatment	162	68 (42%)	67 (41%)	19 (12%)	8 (5%)

Part F: Strategies for EBP	n	Not Useful	Slightly Useful	Moderately Useful	Very Useful
Access to the internet in the college (Banzai et al[29])	163	3 (2%)	9 (6%)	25 (15%)	126 (77%)
Access to free online databases in the college, such as PubMed and Index to Chiropractic Literature	161	0 (0%)	3 (2%)	25 (16%)	133 (83%)
Free access to online databases that usually require license fees, such as CINAHL and AMED, etc	160	2 (1%)	9 (6%)	24 (15%)	125 (78%)
The ability to download full text/full-length journal articles	163	0 (0%)	6 (4%)	17 (10%)	140 (86%)
Access to online education materials related to evidence-based practice	163	0 (0%)	8 (5%)	26 (16%)	129 (79%)
Access to tools used to assist the critical appraisal/ evaluation of research evidence	162	2 (1%)	14 (9%)	30 (19%)	116 (72%)
Access to critically appraise topics relevant to your field (these are critical appraisals of single research papers)	163	2 (1%)	13 (8%)	40 (25%)	108 (66%)
Access to critical reviews of research evidence relevant to the practice of chiropractic (these are critical reviews of multiple research papers addressing a single topic)	162	0 (0%)	12 (7%)	37 (23%)	113 (70%)
Access to research rating tools that facilitate critical appraisal of single research papers	162	5 (3%)	28 (17%)	34 (21%)	95 (59%)
Access to online tools that assist you to conduct your own critical appraisals of multiple	161	8 (5%)	23 (14%)	33 (20%)	97 (57%)

EBASE: Evidence-Based practice Attitude and utilization SurvEy; EBP: evidence-based practice.

was an average response of 3.83 from a maximum score of 5 in the EBASE questionnaire. In its totality, the respondents had an overall positive attitude towards EBP. In our final model, 7 predictor variables remained with a 10-fold cross validation mean square error (MSE) of 19.59.

In Figure 2 and Table 3, we report the summary of the predictor effects on "Overall EBP Perception." Figure 2 visualizes the predictor effects for the variables while averaging over all other variables in the model. As an example, the Literature Confidence Q2 plot (upper left) has a clear linear relationship on overall EBP perception where higher levels of Literature Confidence as reported by this question predict a more positive perception of EBP. We report the analysis of deviance summary in Table 4. We observed a strong, highly significant effect from the following questions: (1) Literature Confidence Q2 ("I am confident in applying research evidence to clinical practice."); (2) EBP Barrier Q9 ("Lack of interest in evidence-based practice."); (3) Professional Association Q5 ("Member of 'Other' Association."); and (4) quarter of study ("What quarter are you currently enrolled?"). We observed weaker but significant effects for the following questions: (5) EBP Strategies Q6 ("Access to tools used to assist the critical appraisal/evaluation of research evidence.") and (6) EBP Strategies Q10 (ie, "Access to online tools that assist you to conduct your own critical appraisals of multiple research papers related to a single topic.").

Effect estimates provided in Table 3 were reported on a multiplicative scale since a log-link function was used. The parameter estimate for Literature Confidence Q2 is equal to 0.035. Since this is a log model, this estimate needs to be exponentiated using the natural constant e (ie, 2.72) as the base (for example, $e^{0.035} = 1.035$). Therefore, for a 1 unit increase in Literature Confidence, we predicted a 1.035 increase in overall EBP perception. The increase in overall EBP is in fact 3.5% larger than the increase occurring for Literature Confidence, but this is clearly not conventional or accommodating. For EBP Q9 (ie, parameter estimate = 0.029), a 1 unit increase in the question response would yield a 2.9% increase/improvement in predicted perception of EBP. For Professional Association Q5, an increase from "No Other Associations" to "Other Associations" yielded a 10% increase/improvement in predicted perception of EBP. For the quarter of study question, "What quarter are you currently enrolled?", post hoc testing was performed using Tukey adjusted comparison of group means. The results are summarized in Tables 5 and 6. The results of the Tukey adjusted comparison of means shows that the perception of

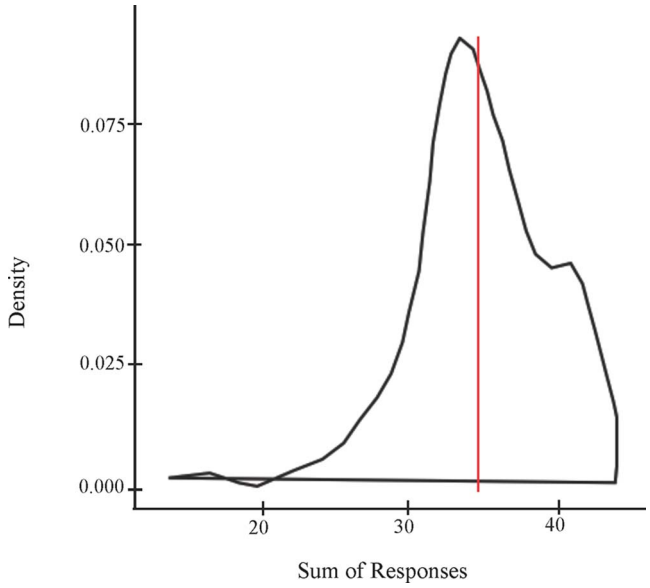

Figure 1 - Kernel density estimate of overall evidence-based practice (EBP) perception.

Table 3 - Model Effects Summary for Gamma GLM with Log-Link Function

	Estimate	SE	*t* Value	Pr(>|t|)
(Intercept)	3.290	0.0788	41.729	<.0001
Literature Confidence Q2	0.035	0.0096	3.645	.0004
EBP Barrier Q9	0.029	0.0099	2.885	.0045
EBP Strategies Q5	−0.038	0.0248	−1.519	.1308
EBP Strategies Q6	0.042	0.0192	2.171	.0315
EBP Strategies Q10	0.026	0.0123	2.087	.0386
Pro Association Q5 (None/Other)	0.102	0.0321	3.161	.0019
Quarter (1–4 to +13)	−0.057	0.0301	−1.886	.0612
Quarter (1–4 to 5–8)	−0.078	0.0302	−2.568	.0112
Quarter (1–4 to 9–12)	−0.079	0.0252	−3.126	.0021

Dispersion parameter for Gamma family = 0.0157456; null deviance: 3.8097 on 159 degrees of freedom; residual deviance: 2.7778 on 150 degrees of freedom; Akaike information criterion: 959.57; EBP: evidence-based practice; GLM: generalized linear model.

EBP for students in quarters 1–4 is different from that of students in quarters 5–8 and quarters 5–9. However, we do not have evidence that perceptions of EBP for students in quarters 13+ is different from those of quarters 1–4.

Identification of "barriers to EBP" and "value of access strategies to EBP" have a significant effect on the respondents' perception of EBP. We found that a student's interest in EBP (or lack thereof) was a significant barrier while an increased interest in EBP had a positive association with their predicted perception of EBP. The student's value of tools that assist in the critical appraisal of literature was a positive association with the perception of EBP. Other EBP barriers and strategies may also have had an important relationship with Overall EBP Perception. However, the absence of these other elements may be a result of collinearity (ie, strong mutual dependencies) with highly significant and stable variables that remained in our modelling.

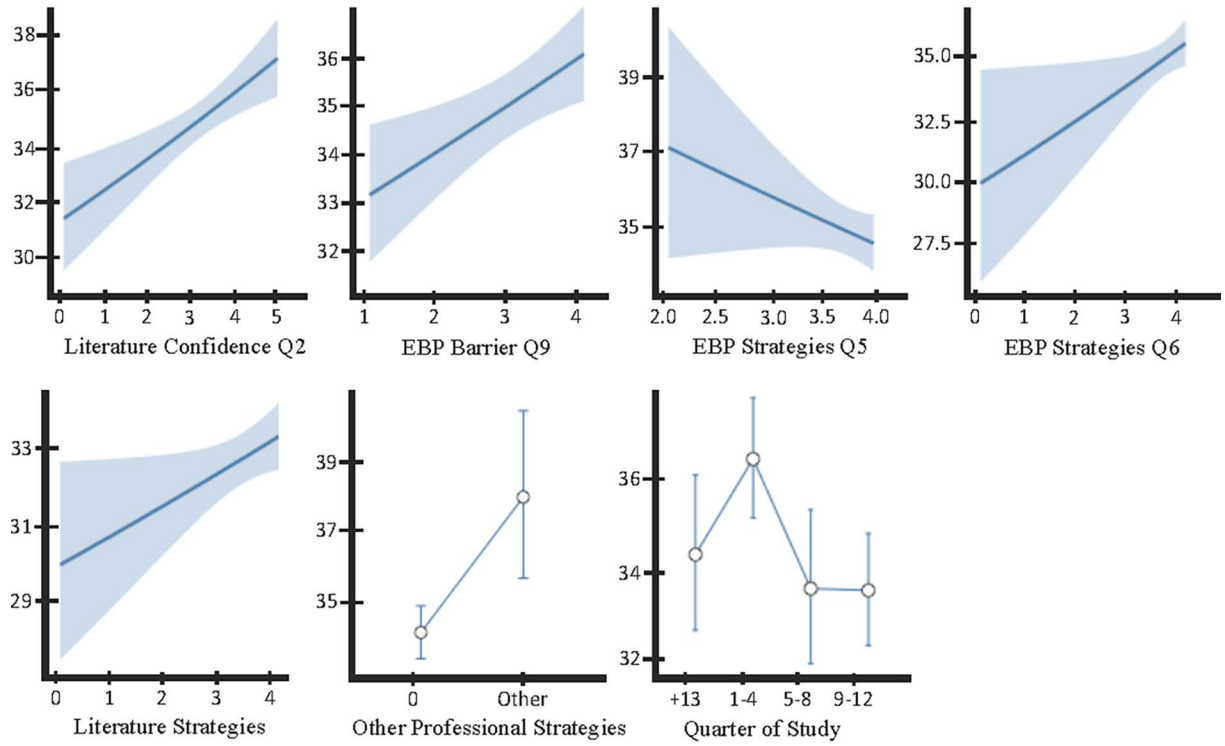

Figure 2 - Average predictor effects for gamma generalized linear model (GLM) with log-link function.

Table 4 - Analysis of Deviance

	DF	Deviance Residual	DF	Residual Deviance	Pr(>Chi)
NULL	—	—	159	3.8097	
Lit Confidence Q2	1	0.2321	158	3.5777	.0001
EBP Barrier Q9	1	0.2777	157	3.3000	<.0001
EBP Strategies Q5	1	0.0312	156	3.2688	.1593
EBP Strategies Q6	1	0.1244	155	3.1444	.00494
EBP Strategies Q10	1	0.0778	154	3.0666	.02622
Prof Assoc Q5	1	0.1055	153	2.9611	.0096
Quarter	3	0.1832	150	2.7778	.0087

DF: degrees of freedom; EBP: evidence-based practice.

Student confidence in applying research evidence to clinical practice was also positively associated (and highly significant) with Overall EBP Perception. We also found that student involvement in "Other/nonchiropractic" professional associations was a positive association with Overall EBP Perception. As previously commented, students earlier in their chiropractic education were also predicted to have the highest Overall EBP Perception.

We acknowledge that our sampled data in its initial state does not merit a fair sample for regression analysis.[15] Regularization or stepwise selection are considered appropriate first steps to addressing the issue of over-collection of variables.[16] The predictive modeling analysis on Overall EBP Perception utilized GLMs of various distribution families and link functions, random forest regression, ridge, lasso and elastic net regularization. Table 7 is a summary of the 5 candidate models that were considered for our analysis. Although we utilized Akaike information criterion (AIC) and Bayesian information criterion (BIC) stepwise selection techniques, this was only performed to reduce our selection of candidate variables. The final GLM model was chosen based on minimized MSE, and the presence of variables that were identified as important predictors in the random forest model and the elastic net model. These other models, although having lesser predictive accuracy in this application, identified quarter of study to be an important predictor even though some of the GLM models did not retain it. The GLM model chosen did in fact retain this variable and using Tukey multiple comparison testing,[17] we verified that significant differences in overall EBP perception did exist across various levels of quarter of study. In this model selection process (Table 1), priority was placed on model performance and interpretability and agreeing features between tuned models. Our final selected model was a GLM with a gamma distributed dependent variable and a log link function (ie, Gamma GLM). GLM model selection was performed using stepwise AIC and BIC selection. Gaussian and Gamma GLM families were considered with their respective link functions. For all candidate models constructed under stepwise AIC and BIC selection, 10-fold cross-validation was used to assess each model's predicted performance by MSE. Candidate models performed with MSE's in the range of 19.4 to 21.0, observed to be an improvement over our candidate random forest model and elastic net regression model. Our final model was chosen considering AIC and BIC, MSE, the number of covariates in the model, and comparisons to our random forest regression and elastic net regression results. A

Table 5 - Post Hoc Multiple Comparisons Using Tukey Adjustment

Quarters of Study	Grouping
Quarters 1–4	A
Quarters 5–8	B
Quarters 9–12	B
Quarter +13	AB

Tukey post-hoc multiple comparison testing on the final GLM model was performed to examine the differences in levels of "quarter of study," a significant factor in our model. This variable was of particular interest since it was ultimately the only indicator of educational progress that we can relate to overall perception of EBP.[17]

DISCUSSION

To date and to the best of our knowledge, this is the first use of the EBASE instrument to examine the skills, attitude and use of EBP by chiropractic students. Our examination of the literature revealed 8 manuscripts utilizing the EBASE questionnaire among chiropractors but none in chiropractic students.[18–25] Seven studies utilized the EBASE instrument to examine the attitudes, skills, training, knowledge, barriers, facilitators and use of EBP by chiropractors in various countries[18–24] while 1 study utilized the EBASE instrument to test the effectiveness of an online program on the attitudes, skills, and use of EBP in a sample of chiropractors.[25] The vast majority of chiropractor respondents in these studies held favorable attitudes towards EBP.

Our findings on the use of the EBASE questionnaire on chiropractic students are consistent with those found among chiropractors. The majority of our study respondents had a positive attitude towards EBP in chiropractic practice and its adoption was indicated as not an unreasonable demand or that there was a lack of evidence from clinical trials to support chiropractic practice. Identified skill deficits (ie, poor skills in conducting systematic reviews and clinical trials) and minimal training (ie, having none or minimal training in the aforementioned EBP skills) in EBP were similar among chiropractic students and chiropractors. In terms of indicated use of EBP, both chiropractic students and chiropractor respondents indicated as having "never" read/reviewed or only "1–5 articles" of professional literature or clinical research findings or the use of the internet and research databases to inform clinical decision-making. As with chiropractor respondents, chiropractic students identified lack of time and lack of clinical evidence as barriers to EBP in chiropractic as well as lack of industry support. Facilitators to EBP (ie, online access, tools for critical appraisal and systematic reviews) were similarly identified by both groups as moderately useful to very useful for EBP. Ceteris paribus ("all other things being equal"), the identified deficits in the skills, training, knowledge, barriers and use of EBP among chiropractors may be the result of deficits in educational strategies on EBP during the chiropractic matriculation.

Although previous studies have also examined attitudes, skills, training, knowledge, barriers, facilitators and use of

Table 6 - Supplementary Information of Tukey Difference Estimates with Significance Levels

	Estimate	SE	z Value	Pr(>|z|)
(1–4) − (+13) = 0	0.056678	0.030055	1.886	.23189
(5–8) − (+13) = 0	−0.020995	0.033976	−0.618	.92571
(9–12) − (+13) = 0	−0.022101	0.029800	−0.742	.87917
(5–8) − (1–4) = 0	−0.077673	0.030247	−2.568	.04964
(9–12) − (1–4) = 0	−0.078779	0.025200	−3.126	.00955
(9–12) − (5–8) = 0	−0.001106	0.029957	−0.037	.99998

EBP by chiropractic students, our study provides the most cohesive and comprehensive examination of EBP attributes in chiropractic students. Zhang[26] examined the student attitudes towards research at 1 chiropractic institution. With a response rate of 40%, Zhang[26] found that 35% of the students were interested in conducting chiropractic research prior to matriculation, 90% indicated positive experience with chiropractic and wanted to investigate further, and more than two-thirds felt that chiropractic research was a vastly unexplored area. These findings resonate with our student respondents on their interest in learning or improving the skills necessary to incorporate EBP into their future practice and the need to address the lack of evidence from clinical trials to support chiropractic practice.

To examine the effectiveness of a problem-based educational strategy for teaching evidence-based healthcare (EBHC) to chiropractic interns ($N = 31$), Fernandez et al[27] examined the effectiveness of 2 educational workshops on constructing clinical questions and critical appraisal of published research and independent patient-based EBHC assignments. A qualitative self-assessment survey was administered before and after a 6-week period of these EBHC activities to measure their effectiveness. Eighty-one percent of the interns completed the pretest-posttest surveys. There were statistically significant differences in interns' self-assessed ability to construct an answerable clinical question and appraise research articles and apply them to patient management, as well as their rating of importance of EBHC in patient decision-making. This also resonates with our findings that chiropractic students need to be adequately trained in EBP skills such as identifying answerable clinical questions, critical appraising and applying/using research evidence in clinical practice.

Smith et al[28] utilized didactic, experiential, and Socratic methods to teach literature retrieval, critical appraisal, and critical thinking skills to chiropractic students at 1 US chiropractic college. The students' attitudes, perceived abilities, and knowledge and skills on EBP improved. For example, student's perceived abilities to search for and critically evaluate research literature improved. These were also identified by our student respondents as important components to EBP in chiropractic. Banzai et al[29] examined chiropractic student attitudes, behaviors, and knowledge about EBP principles. Fourteen institutions from Australia, Canada, United States, Denmark and New Zealand participated in the study. With a response rate of 9.4%, 674 students participated in the survey. Most respondents generally agreed that the use of research evidence in chiropractic was important, most reported having access to medical/healthcare literature through the internet, but only 11% read literature every week and 21% did not read literature at all. Although the majority of respondents found it easy to understand research evidence and had some level of confidence assessing the general worth of research articles, the majority also indicated they needed more training in EBP to be able to apply evidence in chiropractic care. We identified a number of these as positive perception of EBP (ie, EBP is necessary in the practice of chiropractic), training in EBP (ie, adequacy of training in EBP) and EBP skills (ie, applying research evidence to patient cases and critical appraisal of evidence) and performing applying EBP activities such as reading articles to inform clinical practice.

As in the EBASE instrument, Haas et al[30] evaluated the effects of the curriculum on EBP knowledge, attitudes, and self-assessed skills and behaviors of chiropractic students at Western States University. Students from the last entering class under an old curriculum were compared with students in the first 2 entering classes under a new EBP curriculum. The assessment instruments for evaluating the study outcomes were developed specifically for this study.[31] Haas et al[30] found that there was a statistically significant cohort effect with each succeeding cohort for the knowledge examination on EBP. A similar pattern in cohort and quarter effects was found with behavior self-appraisal for greater time accessing databases such as PubMed. Student self- appraisal of their skills was higher in the 11th quarter compared with the 9th quarter.

Table 7 - Summary Finding of 5 Candidate Models Considered for Methods of Analysis

Model Type	CV MSE	Number of Variables	AIC	BIC	Family	Link Function	Number of Trees
Elastic Net (λ_{min})	21.40	16	—	—	Gaussian	—	—
Random Forest	21.80	51	—	—	—	—	500
Stepwise GLM	19.89	10	929.23	969.21	Gaussian	Identity	—
Stepwise GLM	19.91	6	934.61	959.21	Gaussian	Log	—
Stepwise GLM[a]	19.59	9	959.57	993.39	Gamma	Log	—

AIC: Akaike information criterion; BIC: Bayesian information criterion; CV MSE: cross validation mean square error; GLM: generalized linear model.
[a] Chosen model.

All cohorts rejected a set of sentinel misconceptions about the application of scientific literature (ie, practice attitudes).

In a study investigating North American chiropractic students' opinions concerning professional identity, role and future, Gliedt et al[32] found the majority of their respondents agreed or strongly agreed that it was important for chiropractors to be educated in EBP, that it was appropriate to allow for updating and enrichment of chiropractic theories based on current scientific advancements, that contemporary and evolving scientific evidence is more important than traditional chiropractic theory and that it was important for chiropractors to hold strongly to traditional chiropractic theories and practices. These are consistent with our findings of a positive perception of EBP in chiropractic students, at least to the teaching institution of study and the need for more research to support clinical practice.

In a web-based cross-sectional survey of Australian and New Zealand chiropractic students ($n = 347$), de Luca et al[33] found that the majority of their respondents strongly agreed or agreed that it was important for chiropractors to be educated in EBP and that chiropractic theories should be updated and enriched based on current scientific advancements. This is inline with our findings that chiropractic students value training or education on EBP principles and its application to chiropractic practice.

Interestingly, Innes et al[34] investigated the proportion of Australian chiropractic students who hold nonevidence-based beliefs in the first year of study and determine how this proportion varies over the course of the chiropractic program. Their study was anchored on 2 sets of questions. The first asked chiropractic students how often they would give advice to patients in their practices for 5 common health conditions: stress, cardiovascular disease, diabetes, musculoskeletal (MSK) problems, and wellness in general. According to the authors, they expected students' responses to be more frequently "no or rarely" or "sometimes" to the question on non-musculoskeletal conditions (ie, diabetes). The second set of questions in this section asked students for their opinion as to whether "chiropractic spinal adjustments" could prevent or help 7 health-related conditions (ie, help immune system, easier birth, improve the health of infants). The authors found that students were highly likely to offer advice (often/quite often) on a range of non-musculoskeletal conditions. The proportions were lowest in the first year and highest in the final year. The investigators also found that high numbers of students held non-evidence-based beliefs about "chiropractic spinal adjustments," which tended to occur in gradually decreasing numbers in sequential years, except for fifth year when a reversal of the pattern occurred.

Recently, Odhwani et al[35] examined the self-perceived importance of skills, utilization, barriers, and facilitators of EBP among faculty and students at a chiropractic institution without a structured EBP program. A total of 417 (60.1%) students and 27 (60.0%) faculty members completed the survey. Similar to our findings, faculty and students held similar values on the importance of EBP but faculty members self-reported their EBP skills at a higher level than the student self-reported skill level. For utilization, students reported a higher utilization of EBP than that reported by the responding faculty members. Perceived student satisfaction on the quality and content of research-related experiences decreased from the first year to the third (final) year. This is consistent with our findings that student satisfaction with the quality and content of research-related experiences decreased from the first year to the third (final) year. Odhwani et al[35] found that overall, the self-perceived EBP skills to EBP were lagging in their institution due to a lack of structured EBP program.

Our use of the EBASE instrument utilized sophisticated statistical analysis to determine a number of EBASE variables that contributed to overall EBP perception. In terms of student attributes, we found that students earlier in their curriculum (ie, Q1–4) compared with students in later quarters of study (ie, quarter 5–8, quarter 9–12 and quarter 13+) and having or a student affiliation with a chiropractic organization (ie, International Chiropractic Pediatric Association, International Chiropractic Association, American Chiropractic Association) resulted in a more positive perception of EBP. Leach et al[21] commented that chiropractic associations and unions may play a pivotal role in propelling policy and practice recommendations on the importance of EBP uptake, promoting advances in chiropractic research, and communicating evidence-based chiropractic to the profession and wider community, including government, patients and other healthcare providers. This also resonates with the findings of Odhwani et al[35] that student satisfaction with the quality and content of research-related experiences decreased from the first year to the third (final) year. Although the majority of our study respondents indicated items that identified barriers to EBP were minor or not a barrier, our analysis identified and determined the extent to which item 9 (ie, lack of interest in evidence-based practice) of the Barriers to EBP was a significant determinant of overall EBP perception. The majority of our respondents indicated that they were not so confident in conducting systematic reviews or meta-analysis (ie, statistical analysis), conducting clinical research (ie, clinical trials) or feel adequately trained in EBP/EBM. We identified the question pertaining to confidence in applying research evidence to clinical practice was a highly significant variable to overall EBP Perception. This agrees with the findings of Banzai et al[29] on the need for more training in EBP to be able to apply evidence in chiropractic practice. In terms of strategies towards EBP, access to tools that assist in the critical appraisal or evaluation of research evidence or critical appraisal of multiple research papers related to a single topic were identified as highly significant in contributing to overall EBP Perception.

Our study contributes to the body of literature by describing the attitudes, skills, training, knowledge, barriers, facilitators and use of EBP by a cohort of chiropractic students. We identified a number of variables of importance that contribute to a more positive overall EBP perception. As we previously stated, our findings with chiropractic students may inform education strategies in the training of future and current chiropractors on EBP. Based on our findings, we propose (at least specifically at the educational institution of interest) that educational strategies at this chiropractic setting should (1) promote an increased interest in EBP and (2) assist students in understanding the value of tools for critical appraisal of literature; (3) implement educational strategies that increase students confidence in applying research to clinical practice and (4) encouraging student involvement in independent professional associations. As Schneider et al[18] concluded, EBP educational interventions

should be broadened to include professional, organizational and health policy domains. Further discussion is required on behalf of the effect of the variable "What quarter are you currently enrolled?" Our findings do not necessarily imply that the program at this chiropractic learning institution has lower perceptions of EBP. The results of our findings could be a product of recent improvements in teaching EBP at this institution to new students, student burnout in later quarters, shift in student focus from classroom to clinical practice, and other reasons. It is important to note that no significant difference was detected between students in quarters 1–4 and students in quarter 13 and higher. These results for the effect on student year/quarter yield further questions and thus should be interpreted with the acknowledgement that we are not able to directly identify the source of this difference. Interestingly, the study by Haas et al[30] indicated that a statistically significant cohort effect was observed with each succeeding cohort in their knowledge examination on EBP at their institution. In addition to confirming or refuting our findings, future studies should implement an analysis to study the interaction of quarter/year of study with other variables in the EBASE instrument.

Study Limitations

As we have previously acknowledged, our sampled data in its initial state does not merit a fair sample for regression analysis.[15] There is concern that a sample size of $n = 172$ for a questionnaire with $p = 84$ items is inadequate. Authors such as Pedhazur[36] suggest that in multiple regression analysis, subject-to-variable ratios of 15:1 or 30:1 is crucial when generalization is critical. Comrey and Lee[37] suggested that a subject-to-variable ratio should at least be 5:1 for factor analysis. Based on the adequacy of sample size scale suggested by Comrey and Lee,[37] the sample size in this study of $n = 172$ would be poor ($n = 100$) to fair ($n = 200$).[37] A low subject-to-variable ratio can lead to an increased risk of overfitting, unstable factor solutions and reduced generalizability to the population of interest. This challenge of adequate subject-to-variable ratio in statistical and machine learning methodology has earned multiple names such as the "small n large p" problem and the "curse of dimensionality."[38,39] This is a practical constraint that researchers often face, particularly with healthcare data.[38,40] In brief, most statistical machine learning models are best suited to data with a generous sample size and a smaller set of predictor variables. As previously mentioned, it is common to have data with a smaller sample size and a large number of variables. According to Hastie et al[39] feature selection is an important scientific requirement for a statistical learning model when p is large. There are several ways for researchers to implement feature selection. Common techniques include filter methods that select features based on their statistical relationship to the target variable. As we have performed in our analysis, final models were selected based on 1 or more criteria including model predictive performance, model fit indices (ie, AIC, BIC), and number of predictor variables in a candidate model. Our final model had $p = 7$ variables and a sample size of $n = 172$. Based on this criterion, a sample size of $n = 172$ is adequate for interpretation of a regression model and within the guidelines set by Pedhazur[36] and Comrey and Lee.[37]

Our study is a unique exploratory analysis of attitudes of chiropractic students towards EBP. As with research in the medical education setting,[41] there are challenges to performing research in chiropractic education. The most notable are time constraints, lack of interest, and a focus on clinical care rather than participating in research on the part of students. There are also resource constraints faced by faculty such as time, budget and logistical constraints. Despite our sample size of 172, we collected responses from students from various quarters to ensure diversity and representativeness within our sample. A limited sample size is a practical constraint that researchers often face, regardless of the setting. We note that among 8 studies published thus far involving chiropractor respondents to the EBASE questionnaire, 3 studies[19,21,24] had sample sizes of less than 172. Only 2 studies[18,20] have sample sizes meeting the criteria as set forth by Pedhazur[36] and Comrey and Lee.[37] Schneider et al[18] and Bussières et al[20] had chiropractor respondent samples of 1314 and 554, respectively. As this was an exploratory analysis on the use of the EBASE questionnaire on chiropractic students in 1 institution, we caution the reader on the generalizability of our findings to other chiropractic students at other teaching institutions. However, we have been transparent in our analysis and study findings, and 1 should recognize the need for flexibility and thoughtful consideration of the specific research context, constraints and findings of our study.

As is common in studies utilizing survey instruments, we must acknowledge the limitations of bias—recall or reporting bias (ie, questionable accuracy of recollections by study respondents), social desirability bias (ie, tendency of respondents to provide a response that may be viewed as desirable), and selection bias (eg, study respondents are from a single source rather than multiple sources). Further on selection bias, we acknowledge the presence of non-response bias in our sample of respondents (ie, respondents are unwilling or unable to participate in the survey) and its contribution to selection bias.[41] Nonresponse bias can make valid statistical inferences difficult and invalidate the results of our survey.[42] A further limitation and consequence of bias is the questionable generalizability of our findings to the rest of the chiropractic student population. Despite meeting similar educational standards as dictated by the US Council on Chiropractic Education, Council on Chiropractic Education Canada, Council on Chiropractic Education Australasia and similar regulatory bodies in Europe and other parts of the world, differences exist between chiropractic teaching institutions (ie, chiropractic cultural authority, role in healthcare and use of terms).[32,33,43,44] These differences may lead to differences in the attitudes, skills, and use of EBP among chiropractic students and eventually in their practices. Despite these possible differences, our findings demonstrate that the chiropractors and chiropractic students alike embrace the principles and practice of EBM and chiropractic education has incorporated EBP training for future chiropractors.[45–48]

In lieu of the small sample size and the aforementioned study limitations, we recommend the need for replication of this study in larger samples (ie, study performed at more chiropractic teaching institutions) to validate the results of our study findings on the variables contributing to Perceptions of EBP among chiropractic students. Furthermore, future studies using EBASE should strive to obtain a more representative

sample of chiropractic students based on the aforementioned differences (ie, on chiropractic philosophy, cultural authority, role in healthcare) to further contribute to improving the educational strategies for applying evidence into clinical practice and improve overall patient care.

CONCLUSION

Our use of the EBASE instrument among chiropractic students identified specific items in the EBASE instrument that were highly significant in promoting a positive overall EBP perception or attitude. Overall, the student respondents were supportive of and consider themselves skillful in EBP. However, most also indicated the need for additional training. The utilization of several resources that resonate with EBP were identified with possible barriers to EBP indicated as a nondeterrent to practicing EBP.

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