

Assessing the attitudes, knowledge and perspectives of medical students to chiropractic

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Objective: *To assess second-year medical students' views on chiropractic.*

Methods: *A three-step triangulation approach was designed, comprising a 53-item survey, nine key informant interviews and one focus group of 8 subjects. ANOVA was used to assess attitude-response survey totals over grouping variables. Constant comparison method and NVivo was used for thematic analysis.*

Results: *112 medical students completed the survey (50% response rate). Subjects reporting no previous chiropractic experience/exposure or interest in learning about chiropractic were significantly more attitude-negative towards chiropractic. Thematically, medical students viewed chiropractic as an increasingly evidence-based complementary therapy for low back/chronic pain, but based views on indirect sources. Within formal curriculum, they wanted to learn about clinical conditions and benefits/risks related to treatment, as*

Objectif : *Évaluer les opinions des étudiants de deuxième année de médecine sur la chiropratique.*

Méthodologie : *Une approche de triangulation en trois étapes a été conçue, comprenant un questionnaire de 53 points, neuf entretiens avec des informateurs clés et un groupe de réflexion de 8 participants. La méthode analytique ANOVA a été utilisée pour évaluer le nombre de réponses d'un sondage sur les attitudes par les variables de regroupement. La méthode de comparaison constante et le logiciel NVivo ont été utilisés pour l'analyse thématique.*

Résultats : *112 étudiants en médecine ont rempli le questionnaire (taux de réponse 50 %). Les répondants n'ayant signalé aucune expérience ou exposition en chiropratique ni un intérêt à apprendre la chiropratique avaient une attitude significativement plus négative à l'égard de la chiropratique. Sur le plan thématique, les étudiants en médecine considèrent la chiropratique de*

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Competing Interests: The author AM was a medical student at the University of Toronto but was not a part of the study population. The author DKG is a guest lecturer at the Faculty of Medicine of the University of Toronto. The author KW is a faculty member in the Faculty of Medicine, University of Toronto.

greater understanding was needed for future patient referrals.

Conclusion: *The results highlight the importance of exposure to chiropractic within the formal medical curriculum to help foster future collaboration between these two professions.*

KEY WORDS: attitudes, medical, students, survey, interprofessional

plus en plus comme une thérapie complémentaire fondée sur des preuves, pour la lombalgie ou les douleurs chroniques, mais ces opinions étaient basées sur des sources indirectes. Dans le contexte d'un programme d'études officiel, les étudiants voulaient en apprendre davantage sur les conditions cliniques et les avantages et risques liés au traitement, car une plus grande compréhension était nécessaire pour l'aiguillage des patients futurs.

Conclusion : *Les résultats mettent en évidence l'importance de l'exposition à la chiropratique dans le contexte du programme d'études officiel en médecine pour aider à favoriser la collaboration future entre ces deux professions.*

MOTS CLÉS : attitudes, médical, étudiants, sondage, interprofessionnel

Introduction

Over the last two decades, an increasing number of North Americans have sought out complementary and alternative medicine (CAM) to address their health concerns.¹⁻⁶ Chiropractic was the most frequently accessed CAM therapy in 2005, with a utilization rate of 11% reported by Statistics Canada, for addressing musculoskeletal conditions.^{4,7-9} This is likely due to high patient satisfaction with the quality of care^{10,11}, and growing evidence around the effectiveness^{7,12-17} and safety^{18,19} of chiropractic treatments.

Recent efforts in Canada and worldwide have emphasized the importance of interprofessional education (IPE) and collaboration to reform the healthcare system.²⁰⁻²² In 2010, the World Health Organization produced a framework to position interprofessional collaboration in educational and practice settings as a strategy for mitigating global health workforce crises.²⁰ In Canada, a focus on health professional education has moved academic programs toward curricular reforms involving IPE.²³ Simi-

lar international models have increasingly appeared in peer-reviewed literature and have been incorporated into governmental policies²⁴, with researchers examining how health professionals interact with and perceive each other. Studies have explored how medical students view CAM²⁵⁻²⁸, noting that medical students tend to receive less CAM education than other healthcare students²⁸, despite having an interest to learn more about CAM²⁵⁻²⁷. Medical students^{26,28-34} and practicing physicians³⁵ alike recommended the inclusion of CAM education within formalized medical curriculum especially in the early years^{6,36-38}, and this has been shown to improve attitudes towards CAM^{25,36,39}. With increasing utilization and research with chiropractic, some view the profession as moving away from CAM and towards mainstream healthcare.^{39,40}

A literature search in the Medline database (inception to 2008) was performed, using a combination of MeSH terms and keywords related to medical students, chiropractic and CAM. Reference lists of relevant articles were hand searched for additional articles. A review of the lit-

erature indicated that there were no studies that explored medical students' views on chiropractic independent of other CAM therapies at the start of this study. Therefore, the purpose of this study was to assess the attitudes, knowledge and perspectives of medical students specifically towards chiropractic. Understanding how medical students perceive chiropractic may help facilitate collaboration and enhance interprofessional relationships between the two professions in the long term.

Methods

This study utilized a mixed-methods design with three data collection approaches: a survey questionnaire, key informant interviews and a focus group. The purpose of the *three-step triangulation* approach was to gather rich and in-depth quantitative and qualitative data on potentially diverse views towards chiropractic, with increasingly detailed probes between the key informant interviews and focus group. First, a 53-item survey was developed by the research team to obtain overall attitude, knowledge and perspective scores on chiropractic and then administered to a group of second year medical students. Information from the survey results helped to inform the semi-structured interview guide used in the interviews. The views of medical students to chiropractic were then qualitatively assessed with key informant interviews, which provided an opportunity for medical students to clarify their personal views.⁴¹ Finally, a focus group of 8 medical students was convened to gather thoughts on chiropractic when presented with potentially differing views of their colleagues.

The target population was second year, pre-clerkship medical students (n=224) in a four year program at the Faculty of Medicine, University of Toronto (UT). Second year students were selected because, at that point, they had one year of formalized education in medical school but no formal curriculum on chiropractic. Previous literature also suggests that early year (years 1-2) medical students are more likely to be enthusiastic about learning CAM than later years (years 3-4).^{29,36}

Inclusion criteria included willingness to participate and fluency in English. Exclusion criteria included failure to provide written consent. The study protocol underwent expedited research ethics board review with approvals from UT and the Canadian Memorial Chiropractic College (CMCC) in Toronto, Canada.

Quantitative Stage 1 – Survey:

The methods described by Boynton (2004) and Boynton & Greenhalgh (2004) outlining processes of creating, piloting and administering questionnaires were utilized.^{42,43} The study's self-administered questionnaire was developed through a literature review to discern thematic areas suggested by current studies (Appendix) on medical students' perceptions of CAM therapies. The questionnaire was then reviewed by an experienced qualitative researcher who consulted with the research team and pre-tested on 4 medical students who were not a part of the study population, resulting in modifications to the order and wording of questions. The research team introduced the survey to medical students following a second year community health lecture with the course director's permission. Demographic information (sex and age) was collected to describe the study population, without nominal identifiers. To maintain participants' anonymity, surveys were returned via a dropbox at the classroom exit.

Qualitative Stages 2 and 3:

Key informant and focus group participants had volunteered after an approved classroom announcement was made and subsequent emails were sent to university email accounts. Semi-structured question guides were developed through a literature review and expert advice from an experienced qualitative researcher who consulted with the research team, then revised based on trends from survey results. The qualitative researcher also trained two investigators (JJW and LD) in conducting key informant interviews. Written informed consent was obtained from each participant to participate and audiotape the interviews. Data were transcribed verbatim into written text from the audiotape. Gift cards of \$20.00 (with courtesy lunch at the focus group) were provided to each participant in appreciation of their time.

Stage 2 – Key Informant Interviews:

Key informant interviews followed the analysis of questionnaire results and employed one-on-one, semi-structured interviews of approximately 20 minutes. Purposeful sampling was conducted by researchers to identify medical students willing to share in-depth perspectives on chiropractic and elaborate on survey themes. The interviews were conducted until thematic saturation was reached, with saturation being the point where no new

data was obtained.⁴¹ Saturation (identified through simultaneous and iterative sampling, data collection and analysis) was achieved at 9 key informants. After the first 3 interviews, interviewers reviewed all responses and determined, by consensus, that one additional interview probe was needed to elaborate on an early trend. The additional probe was, “Do you think it is important for your medical school curriculum to include education on chiropractic?” The interviewers did not reveal the participants’ identities, but instead assigned pseudonyms to each participant during the transcription process.

Stage 3 – Focus Group:

A one-hour focus group was conducted with 8 medical students, as research suggests that focus groups should be composed of 6-10 individuals.⁴⁴ This format can elicit ideas that participants might not have considered on their own and inspire additional thoughts.⁴⁴ The purpose of this focus group was for medical students to discuss recommendations for addressing possible barriers to collaboration, in light of differing views of their colleagues. For the most comfortable setting possible, the focus group was conducted in a private setting on UT campus by a research investigator (AM) who was a medical student and not a part of the study population.

A copy of the survey and semi-structured questions for the key informant interviews and focus group is available by contacting the principal investigator.

Statistical Analysis – Survey Questionnaire:

Descriptive statistics (frequencies) were recorded for sex, age and current level of chiropractic understanding. Determined by team consensus, the questionnaire included 15 question-items assessing knowledge of chiropractic, 4 question-items assessing perspective towards chiropractic and 30 question-items assessing attitude towards chiropractic. These questions utilized a 5-point Likert scale of strongly disagree(1), disagree(2), undecided/don’t know(3), agree(4) and strongly agree(5). From the 30 question-items assessing ‘attitude towards chiropractic’, response-totals for attitude-positive (agree/strongly agree), attitude-negative (disagree/strongly disagree) and undecided/don’t know were obtained for each individual to formulate summary measures of attitudes towards chiropractic.

ANOVA was used to assess between-group differences

Table 1.
Demographic Data (N = 112 respondents)

		N	%
Gender	Male	53	47.3
	Female	59	52.7
Age	20-24	64	57.1
	25-29	42	37.5
	30-34	5	4.5
	35-39	1	0.9

on the attitude-response totals over various grouping variables. Since the response totals for attitude (positive, negative and undecided) were stratified and compared over 10 different grouping variables, a Bonferonni corrected p value of 0.005 was used as the standard for statistical significance. Additionally, where a significant p value (<0.005) was found on a grouping variable with 3 or more levels, post hoc comparisons were done using t tests with a further adjusted significance level of 0.005/ (# of levels in grouping variable). R-Project quantitative software was used to perform the analysis.⁴⁵

Thematic Analysis – Key Informant Interviews and Focus Group:

Each transcript was independently analysed by two investigators (JJW and LD) using the constant comparison method, where the data was compared and contrasted for significant phrases and sentences.⁴⁶ The two researchers met to harmonize individual interpretations until consensus was reached on themes, categories and sub-categories. The open coding structure and transcript data were entered into NVivo (v2.0, QSR International Pty. Ltd., Melbourne) for data organization and retrieval.

Results

Quantitative Results:

Demographics:

Of the 224 potential subjects, 112 (50% response rate) completed the survey. There was a relatively equal male (47%) and female (53%) gender split, with the majority (94%) of participants in the age range of 20-29 years (Table 1).

Table 2.
*Attitude towards Chiropractic:
 Positive, Negative and Undecided/Don't Know Responses by Grouping Variables (N=112 respondents)*

		# Positive responses	# Negative responses	# Undecided / don't know responses
	N	Mean(SD)	Mean(SD)	Mean(SD)
Current level of understanding of Chiropractic				
Good	24	16.42 (7.23)	4.54 (5.64)	8.04 (5.71)
Satisfactory	35	12.09 (7.80)	8.49 (7.96)	8.43 (5.92)
Poor	53	10.77 (6.91)*	5.45 (6.32)	12.77 (7.00)**
Previous Chiropractic Experience?				
Yes	49	14.94 (7.80)	4.78 (5.60)	9.29 (6.75)
No	63	10.41 (6.72)**	7.32 (7.58)	11.27 (6.67)
Received Chiropractic treatment?				
Yes	30	15.50 (8.41)	5.43 (6.46)	8.07 (7.06)
No	82	11.26 (6.88)*	6.49 (7.03)	11.26 (6.47)*
Friend/Family member is a Chiropractor?				
Yes	19	18.10 (5.43)	3.53 (3.41)	7.37 (5.29)
No	93	11.23 (7.38)**	6.75 (7.28)	11.02 (6.87)*
Considered Chiropractic as a career option?				
Yes	4	24.50 (2.89)	1.00 (2.00)	3.50 (2.38)
No	108	11.94 (7.27)**	6.40 (6.92)	10.66 (6.73)*
Is interprofessional education (IPE) important to you?				
Yes	94	13.06 (7.67)	5.96 (6.67)	9.98 (6.50)
No	3	7.33 (7.51)	13.33 (12.86)	8.33 (6.66)
Unsure	14	9.86 (5.10)	6.71 (6.72)	12.43 (7.08)
Are you aware of the current scientific evidence for Chiropractic treatment?				
Yes	11	17.26 (7.16)	6.55 (7.99)	5.18 (3.82)
No	82	12.18 (6.80)	5.50 (5.55)	11.32 (6.28)
Unsure	19	10.47 (9.70)	9.05 (10.32)	9.47 (8.61)*
Would you like to learn more about Chiropractic care?				
Yes	75	13.59 (7.25)	4.65 (4.89)	10.76 (6.36)
No	12	6.75 (4.41)	15.58 (10.59)	6.67 (7.40)
Unsure	24	12.00 (7.05)*	6.58 (6.52)***	10.42 (6.52)

* p < 0.05 between groups in ANOVA; ** p < 0.005 between groups in ANOVA ; *** p < 0.0005 between groups in ANOVA

Attitude towards Chiropractic:

Table 2 shows the effect of different grouping variables on totals for attitude-positive, attitude-negative and undecided/don't know responses. Respondents self-reported a wide range of 'level of understanding of chiropractic', with 24 respondents (21.4%) selecting 'good', 35 respondents (31.3%) selecting 'satisfactory' and 53 respondents (47.3%) indicating 'poor'. Individuals with a poor 'current level of understanding of chiropractic' had significantly more undecided/don't know responses than their counterparts ($p < 0.005$). However, results of post hoc multiple comparisons of 'current level of understanding of chiropractic' on undecided/don't know responses totals yielded no specific pairwise differences following further adjustment. Individuals who reported previous experience with chiropractic were significantly more attitude-positive ($p < 0.005$). Specifically, those with a friend or family member who was a chiropractor ($p < 0.005$), considered chiropractic as a career option ($p < 0.005$) or had received chiropractic treatment ($p < 0.05$) were more attitude-positive towards chiropractic. With regards to the question "Would you like to learn more about Chiropractic care?", post hoc comparisons identified individuals that responded "No" as being significantly different from individuals that responded "Yes" ($p < 0.0001$) and individuals that responded "Unsure" ($p < 0.0001$). Thus, individuals with no interest in learning more about chiropractic care were significantly more attitude-negative towards the profession.

Knowledge on Chiropractic:

Fourteen items were used to assess subjects' knowledge regarding chiropractic care/treatment. Participants were asked to select agree, disagree or undecided/don't know about various types of care (e.g. acute, chronic, preventive) and types of treatment modalities (e.g. joint manipulation, soft tissue therapy, exercise prescription) provided by chiropractors. When asked about the types of treatment chiropractors can provide within their scope of practice, subjects either indicated an incorrect response or selected undecided/didn't know 50.4% of the time. Subjects lacked knowledge in the following care/treatment areas: nutritional information (84%), acute care (74.1%), acupuncture (72.3%), preventative care (67.2%), and therapeutic modalities (66.1%). 9.9% of respondents indicated that they were aware of current scientific evidence

Table 3.
Perspective on Chiropractic (N=112)

	Category	N	%
Chiropractic is <i>mainstream</i> profession in health care.	Strongly disagree	5	4.5
	Disagree	26	23.2
	Undecided/do not know	49	43.8
	Agree	30	26.8
	Strongly agree	2	1.8
Chiropractic is a <i>complementary and alternative medicine (CAM)</i> profession.	Strongly disagree	1	0.9
	Disagree	4	3.6
	Undecided/do not know	22	19.6
	Agree	69	61.6
	Strongly agree	16	14.3
From your experience, UT medical school educators are knowledgeable about chiropractic.	Strongly disagree	5	4.5
	Disagree	37	33.0
	Undecided/do not know	60	53.6
	Agree	5	4.5
	Strongly agree	0	0
	N/A	5	4.5
Is interprofessional education (IPE) important to you?	Yes	94	83.9
	No	3	2.7
	Unsure	14	12.5
	N/A	1	0.9

on chiropractic care and treatment, while 73.2% indicated that they were not aware and 16.9% were unsure if they were aware.

Perspective on Chiropractic:

Four questions explored the perspectives of medical students on chiropractic. These were differentiated from attitude questions on the basis that 'perspective' responses did not have a positive or negative connotation, but were neutral instead. These questions explored whether medical students considered 1) chiropractic a mainstream or CAM profession (2 questions) 2) their medical school educators knowledgeable regarding chiropractic and 3) IPE as important (Table 3). In regards to whether chiropractic was a mainstream or CAM profession, there were 21/112 (18.8%) respondents who endorsed both beliefs.

Qualitative Results:

Participants' use of specific dialogue in the key informant interviews and focus group provided a context for assessing their attitudes, knowledge and perspectives toward chiropractic. The following themes were identified:

Exposure to and knowledge on chiropractic:

The subjects' knowledge of chiropractic and its education process was limited to the program length (4 years), general anatomy and treatment technique components. They were not familiar with other courses in the chiropractic curriculum. Some participants viewed the intensity and basic course work of chiropractic training similar to that of medical students. Their limited chiropractic knowledge was largely based on indirect sources of information, such as conversations with friends, small group tutors and in student clubs, without formal lectures on chiropractic in their medical curriculum up to that point in second year. Some experiences gave them a negative impression of chiropractic.

"I do remember hearing some injuries that can be caused when people have some specific condition, but I don't think we've ever had anything really too positively that I can recall in lecture." (FG:23)

Chiropractic in medical education:

Participants were interested in learning about chiropractic in their undergraduate medical education, particularly regarding conditions that chiropractors treat, rather than intricacies of treatment methods. Barriers to the inclusion of chiropractic in the curriculum were thought to include lack of emphasis from the medical school administration and lack of time amidst the heavy curricular workload.

"Our professors or curriculum may not be recognizing the importance of giving the value of learning what chiropractic does and the value to us, so I think part of the barriers would be advocating toward those who develop the curriculum to engrain it in our syllabus." (FG:141)

To address these barriers, some students suggested that the information should be taught in appropriate residency specialties, such as family medicine and orthopaedics. Participants noted that the school's IPE program did not formally include chiropractic and may be a well-suited avenue for chiropractic information.

"We did have an interprofessional development day...

and there weren't any alternative medicine or chiropractors, and I feel that would be a good opportunity to introduce students to it." (KI 6:284)

Role of chiropractic in health care:

The medical students felt that the chiropractic profession was becoming more evidence-based, but were not fully aware of the chiropractic literature. There was mention of concern regarding safety issues around chiropractic.

"If I were the practicing physician, I may not choose (chiropractic) treatment for a patient just because I don't understand it. If I understood the risks and benefits to particular patients, I would definitely have a positive attitude towards it and know when to access it." (KI 7:138)

All focus group participants agreed that chiropractic belonged in CAM. The reasons behind this were unclear, as some students mentioned it was because chiropractic was not formally taught in the medical curriculum, while others again questioned the evidence and legitimacy behind chiropractic. There was confusion surrounding the differences between chiropractic and CAM.

"(Chiropractic) is not really part of the curriculum, so I don't really consider it conventional mainstream." (FG:224)

"It's been told before in lecture that CAM is not necessarily based on randomized-controlled trials and evidence." (FG:74)

Chiropractic in clinical settings:

In practical settings, the respondents viewed chiropractors as practitioners commonly treating low back and chronic pain with spinal manipulation. Most subjects were aware that chiropractors performed manipulations, but were not familiar with the details of this procedure. There was confusion around the differences in educational training, treatment, and government funding between chiropractors, physiotherapists, and registered massage therapists.

"The focus of chiropractors is the spine specifically versus physiotherapists would work on virtually anything, and not limited to the spine...though I don't know that's an exclusion per se." (FG:238)

"The funding model of healthcare doesn't cover chiropractic as much as they do physiotherapy, which might have won over the general public's belief but is probably shifting as we speak in terms of healthcare today." (FG:301)

To transition from education to practice, participants felt that the benefits of learning about and collaborating with chiropractors were based around patient-centred principles. The understanding of chiropractic and its evidence was associated with greater comfort in referring future patients, but subjects wanted to know when to refer and for what conditions.

“If (chiropractors) are part of the same healthcare team then it would be easier for the patient to access all the services in the same place and part of the same group of circle of care.” (FG:274)

Discussion

The majority of respondents considered chiropractic a CAM therapy that was becoming more evidence-based. A number of respondents (18.8%) endorsed both beliefs that chiropractic was a mainstream and CAM therapy, which may reflect the increasing utilization and research with chiropractic that has shifted the perception of the profession from CAM and towards mainstream healthcare.^{39,40} No previous experience with chiropractic or interest in learning about chiropractic were significantly associated with more negative attitudes towards the profession. When asked about scope of practice and treatment modalities of chiropractors, approximately half of respondents had either incorrect or undecided responses. This limited chiropractic knowledge was mainly based on personal conversations or informal discussions at school, some of which promoted a negative impression of chiropractic.

Generally, most respondents were unaware of the current scientific evidence on chiropractic and wanted to learn more about the profession. In key informant and focus group discussions, barriers to the inclusion of chiropractic in the medical curriculum were hypothesized as lack of time, heavy course load and perceived lack of importance given by faculty. The participants suggested that IPE and appropriate residency specialties, such as family medicine and orthopaedics, were suitable routes for adding additional chiropractic content into the medical curriculum. In one-on-one and group discussions, the majority of participants wanted to learn about conditions deemed most appropriate for chiropractic treatment by its reported effectiveness and safety in research literature. The main motivating factor behind learning about chiropractic was the facilitation of appropriate referrals to chiropractors for patient-centred care.

These findings generally reflect trends in other research that examined medical students' view on chiropractic amid other CAM therapies. Similar to a 2007 paper-and-pencil survey of 260 (response rates were 65% of all first year students, 91% of all second year students) early year medical students, the majority of subjects wanted education on chiropractic (deemed the second most desired CAM profession to learn about, after acupuncture) to sufficiently advise patients and refer for its use.²⁵ In previous studies, medical students often relied on external sources for information¹⁵, and wanted formal CAM education in the medical curriculum^{26,28-34}, as increased knowledge has been associated with more positive attitudes towards that profession^{25,36,39}. To address this, Wetzel et al. (2003) suggested that medical curricula define a core curriculum on CAM, which incorporates CAM into patient cases in standard lectures and offers student exchanges with other professions for experiential learning.⁴⁷ This is a multi-faceted approach that has also been suggested for IPE.⁴⁸ Having identified heavy course load and lack of time as barriers, which parallels the concerns of this study's respondents, this method may be used to introduce chiropractic in an integrated and longitudinal fashion into existing medical curricula.

Specifically, respondents wanted information on the evidence and role of chiropractic treatments for musculoskeletal conditions, particularly spinal manipulation. This was also reflected in the number of undecided/don't know responses in the questionnaire, though the percentage of these responses did not vary much across Table 2, which suggests that these respondents were the same individuals. Since spinal manipulation is generally supported by practice guidelines^{49,50}, systematic reviews⁵¹⁻⁵⁴ and literature synthesis⁵⁵ for musculoskeletal complaints, one barrier to chiropractic understanding may be the limited exposure to its evidence. Safety concerns by some medical students in the study's qualitative sessions may also reflect the lack of exposure to most recent evidence, particularly around stroke. Although earlier reports suggested an association with vertebrobasilar artery dissection and cervical manipulation⁵⁶⁻⁵⁸, recently published high-quality methodological studies have failed to confirm this association^{21,22}. In 2008, an ecological study failed to confirm an association between increased chiropractic use and increased risk of stroke¹⁸, while a population-based case-control and case-crossover study failed to confirm an association

between chiropractic care and increased risk of stroke as compared to primary care¹⁹. In light of feedback from our participants, it is recommended that evidence-based research on chiropractic efficacy^{49-54,59-64}, safety^{18,19}, and cost-effectiveness^{16,62-64} should be highlighted in course lectures on chiropractic⁶⁵⁻⁶⁷.

With respect to scope of practice, the respondents perceived chiropractors as mostly treating low back and chronic pain with spinal manipulation, but remained uncertain about when to refer patients to chiropractors. This lack of clarity regarding the role of chiropractors in collaborative practice may become a barrier to collaboration in the clinical setting. This was also suggested by Branson in his 2004 evaluation of a 10-year hospital-based chiropractic program.⁶⁸ In a 2009 mail survey of 487 (49% response rate) orthopaedic surgeons in North America, Busse et al also found that orthopaedic surgeons had diverse views on chiropractic, ranging from extremely negative to very positive, and only 51.4% of surgeons referred some patients to chiropractors each year, mainly due to patient request.³⁵ Improved understanding of chiropractic training and evidence for chiropractic treatment may help medical students later develop a trusting relationship and patient referral network with chiropractors, which is integral to successful collaboration.⁶⁹ The main reason that our respondents wanted to learn about chiropractic was to improve patient care, and appropriate exposure is suggested to positively impact their future collaboration with chiropractors.²⁹

Other authors have postulated that until education about chiropractic is implemented early in the medical curriculum, medical students may be susceptible to developing negative attitudes.²⁹⁻³⁶ Parsell et al identified more negative attitudes at later stages of training and, therefore, education about chiropractic early in the curriculum³⁷ or at younger years³⁸ may help minimize this occurrence⁷⁰. Since participants expressed a desire to learn, an issue may be that students interested in IPE need support from faculty, as recommended by Hoffman et al.⁷¹ A lack of formal curriculum may further impede positive learning, as reflected in reports of “hidden curriculum” in medicine⁷² and marginalization of minor professions by medicine⁷³. Hidden or informal curriculum occurs when knowledge regarding certain topics is obtained through unintended lessons in education that may promote unplanned inequalities.⁷⁴ The negative discussions expressed by this

study’s participants coincide with findings of Busse et al, where 28.6% of orthopaedic surgeons had been exposed to information on chiropractic during medical school, of which only 7.2% reported favourable information.³⁵

This is likely to have further implications in clinical practice. A recent qualitative study, involving focus groups of health professionals, suggested a need for formalized and standardized teaching in interprofessional collaboration at the student level to enable future health professionals to work in teams.⁷⁵ This need to develop collaboration among different health care students may begin with addressing negative attitudes that may be present prior to their medical education or start early on in their training.

Strengths and Limitations:

To the research team’s knowledge and based on a thorough literature search, there are no existing studies that specifically explore medical students’ views on chiropractic independent of CAM. However, this study has limitations. First, the results may have limited generalizability to medical students as a whole. A survey response rate of 50% (112/224) does not allow for confidence that non-responders would have had similar responses to those provided by responders, though their views were likely explored in the key informant and focus group discussions. Medical schools similarly structured to UT may have comparable results, whereas schools that integrate chiropractic in the formal academic setting may yield a different outcome. For instance, the Osher Institute at the Harvard Medical School has been reported to use an innovative integrated care team that includes a chiropractor among other complementary and mainstream professions, which may influence the model of care at its medical school.⁷⁶

The survey included a response option to certain questions as “undecided/don’t know”. However, ‘undecided’ is not the same as ‘don’t know’, and the use of this category is therefore a limitation to the study. The survey questions were also all in the same direction on the Likert scale and this may have introduced an inherent response bias. Since the study involved one focus group, additional groups may have yielded different information, though saturation was likely reached through the combination of key informant and focus group sessions. The effectiveness of the three-step triangulation approach was not evaluated, so future studies that utilize either key inform-

ant interviews or focus groups alone may yield varying results.

Future Direction:

The research team is currently examining the same group of medical students' attitudes after an educational intervention (a one-hour lecture) about chiropractic provided in their third year, to identify any future changes in attitudes longitudinally.²⁹ This study's results will act as baseline views on chiropractic in the second study. In an earlier study, a one-hour lecture was found to be effective in changing attitudes of students.²⁶ Based on our results, it is important that this one-hour lecture covers the evidence supporting chiropractic treatments for certain conditions, scope of practice and the role of chiropractors in healthcare teams. Eisenberg et al. found that when healthcare providers were trained together, it was beneficial to future collaboration in practice^{1,2}, so the lecture may ideally include other healthcare students and utilize an interprofessional context.

Future research could include a number of possible directions. The study's mixed-methods approach could be used by others when examining interactions among a variety of healthcare professions. Further research could also be conducted once students enter into their clinical training years to identify attitudes, knowledge and perspective of medical students towards chiropractic when transitioning from education to practical application in clinical practice. The one-to-one associations found in this study may have the potential to build a model in future studies that explore how the grouping variables affect one another when combined. Finally, further research evaluating the effectiveness of this *three-step triangulation* methodological approach may also be of value.

Conclusion

The medical students participating in this study expressed an interest in learning about the best available evidence behind chiropractic treatments in order to better understand the role of chiropractors within the healthcare system. This emphasizes the importance of having chiropractic formally taught in the early years of medical curricula and as a part of an IPE program. Further, this formal education will aim to minimize the need for medical students to rely on anecdotal or informal sources of information on chiropractic, and provide a consistent, evidence-based

and accurate understanding of the profession. Improving interprofessional relations between medicine and chiropractic through educational reform and research has the potential of benefiting the patient in practice. Ultimately, one can hope to ensure best patient-centred care by empowering future physicians with the understanding of when to collaborate and appropriately refer patients to chiropractors.

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Authors' contributions:

Authors JJW, LD, AK, KY, AM, and DKG contributed to the design of the study, data analysis, and drafting of the manuscript. Authors DS and KW contributed to data analysis and interpretation, and critical revision of the manuscript. All authors have read and approved the manuscript as submitted.

Abbreviations:

CAM: Complementary and Alternative Medicine; IPE: Interprofessional Education; UT: University of Toronto

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Appendix:

Relevant articles from literature review considered in development of survey questionnaire

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