Assessment of knowledge, attitude, and use of complementary and integrative medicine among health-major students in Western Pennsylvania and their implications on ethics education

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Abstract

Various branches of Complementary and Integrative Medicine (CIM) are growing fast in Western Pennsylvania, similar to other parts of the United States and the world. Little or no knowledge is available about what healthcare providers know and how they think and act regarding CIM. Such knowledge is important for planning for education about CIM and its ethical ramifications for future generations of healthcare providers. In this study, after a qualitative study and literature review, a questionnaire was developed to assess the knowledge, attitude, and use of CIM among health-majoring undergraduate students of PennWest University. The content validity of the questionnaire was confirmed by a panel of experts, and its reliability was assessed by the test-retest method. The weighted agreements for individual questions ranged from 87% to 95%, with kappa ranging from 0.57 to 0.81. The Cronbach's Alpha for the scale was 0.90. the questionnaire was completed by health-major students of PennWest University. To analyze the collected data, we used the Student's t test and the chi-square test with a significant level of 0.05. The participants showed high percentages of familiarity with and use of CIM. Also, they expressed a favorable attitude toward CIM. They also agreed with the necessity of more education about CIM to be included in the curricula. This study concludes that there is a need to incorporate more education on CIM into the curricula of health-related disciplines, with a special focus on the ethical aspects, including the mandate for avoiding untested remedies and following evidence-based clinical practice.

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Introduction

An increasing number of people all over the world use various types of medical care different from mainstream or conventional medicine. These types of medical care are often referred to as integrative, complementary, or alternative medicine. This paper uses the term Complementary and Integrative Medicine (CIM) to refer to this spectrum encompassing a wide range of evidence-based, non-evidence-based, scientific, or pseudoscientific approaches to medical care (World Health Organization (n.d.); National Center for Complementary and Integrative Health 2016). This paper does not use the term "alternative" because of the controversies around the existence of valid alternative branches of medicine. These controversies have led to the removal of this term from the name of the related center at the National Institutes of Health (National Center for Complementary and Integrative Health 2016; Aramesh 2021). However, the term "alternative" is still being used in the literature. Therefore, to cite the literature accurately, this paper uses CIM and CAM (Complementary and Alternative Medicine) interchangeably.

Considering the increasing popularity of CIM among patients and healthcare providers (National Institutes of Health 2024), it is critical that healthcare providers have adequate knowledge and a proper attitude and practice while they provide healthcare for patients who use such services, consider providing CIM for their patients, or refer their patients to CIM providers.

Most health-major students will pursue a career in healthcare. They include undergraduate students with health science, nursing, and other related majors and concentrations such as pre-medical, pre-pharmacy, pre-dental, and pre-physiotherapy.

The participants of this study are students from different campuses (Edinboro and Clarion) of the University of Western Pennsylvania (PennWest). The students of PennWest come from a relatively large geographic area in Western Pennsylvania. This group of students will be a major part of the next generation of clinicians and healthcare providers in that area. Therefore, their knowledge, attitude, and practice toward CIM will significantly impact the quality of healthcare in Western Pennsylvania in the future. While various branches of CIM are growing fast in Western Pennsylvania, similar to other parts of the country, there is little or no knowledge available on what the healthcare providers know and how they think and act regarding CIM.

To explore this important topic, multiple studies have been done and published in other parts of the United States (Lie and Boker 2006; Liu et al. 2014) and other countries, such as Australia (Armson et al. 2020; Shorofi and Arbon 2017), China (Xie et al. 2020), Ghana (Ameade et al. 2016), Jordan (Radi et al. 2018), South Africa (van Rensburg et al. 2020), Saudi Arabia (Albadr et al. 2018), Sierra Leone (James et al. 2016), Palestine (Samara et al. 2019), Singapore (Yeo et al. 2005), Israel (Orkaby and Greenberger 2015), and Iran (Barikani et al. 2015).

There is a knowledge gap on this topic in most parts of the United States, including Western Pennsylvania. No empirical study has been published about the knowledge, attitude, or practice of students or healthcare workers in this area

regarding CIM. Filling this knowledge gap is important to help to complete the country-wide picture, guide the educators and healthcare leaders to plan for the future of education and training for healthcare students, and ultimately, benefit the patients who use, plan to use, or are referred to the practitioners of CIM.

Methods and materials

After obtaining the IRB Approval, this study was conducted in three phases:

Phase 1: Qualitative Study: In November 2022, a focus group of health-major students of Edinboro campus of PennWest University was formed. The focus group included nine students and two facilitators (the Principal Investigator [PI] and a student researcher). The student participants were recruited through announcements posted on the boards and to the members of the relevant student clubs, such as the health professionals club, and by inviting interested students through the PI. The focus group was comprised of representatives from all the health majors and concentrations provided by the school. The meetings and discussions of the groups were continued until the point of saturation.

After obtaining the informed consent of the participants, the discussion was audio-recorded. The questions included: (1) what branches of CIM are you familiar with? (2) have you ever used a CIM treatment or care? (3) How beneficial or harmful do you think CIM is in providing healthcare? (4) what is the importance of knowing about different branches of CIM for health sciences and healthcare students? (5) What major topics should a healthcare provider know about CIM? (6) What makes CIM important?

Phase 2: Questionnaire Development and Validation: In this phase, the research team developed a questionnaire. The first draft was prepared based on (1) a comprehensive literature review and (2) the information obtained in Phase 1. A literature search was conducted in PubMed using various combinations of keywords such as Knowledge, Attitude, Practice, Use, Alternative, Complementary, and Integrative. All the relevant articles, including the previous similar studies, were reviewed, and the questionnaires used in the previous studies were examined to ensure that all the relevant items were included in the first draft of the questionnaire. The study used a Likert-type rating scale format to measure attitude (1 = "Strongly Disagree" to 5 = "Strongly Agree").

Then, the questionnaire's reliability and content validity were tested. For content validity, five experts from the fields of health-related sciences (2), research methodology (1), and bioethics (2) reviewed the questionnaire and confirmed that it measures the intended items properly. The test-retest method was used to assess the reliability. For this purpose, in March 2023, the research team asked 30 PennWest students to fill out the questionnaire twice in two weeks. The weighted agreements and Cronbach's Alpha were calculated to test the questionnaire's reliability. The weighted agreements for individual questions ranged from 87% to 95%, with kappa ranging from 0.57 to 0.81. The Cronbach's Alpha for the scale was 0.90.

Phase 3: Quantitative Study: After preparing a valid and reliable questionnaire as described above, the questionnaire (Table 1) was emailed to all the

Table 1 Demographics and Characteristics of The Students Who Filled Out the Questionnaire

Characteristic		Total responses, n (%) *
Age	18–19	49 (44.6)
	20–24	58 (52.7)
	>=25	3 (2.7)
Gender	Male	13 (11.8)
	Female	96 (87.3)
	Other	1 (0.9)
Major - Concentration	Health Sciences	24 (21.8)
	Nursing	80 (72.7)
	Other	6 (5.5)
Minor	No Minor	62 (56.4)
	Psychology	19 (17.3)
	Chemistry	3 (2.7)
	Biology	17 (15.4)
	Other	9 (8.2)
Campus	Edinboro	79 (71.8)
	Clarion	31 (28.2)
	California	0
Academic Year	Freshman	31 (28.2)
	Sophomore	22 (20.0)
	Junior	23 (20.9)
	Senior	33 (30.)
	Other	1 (0.9)
Primary Residence	In Pennsylvania	89 (80.9)
	Outside Pennsylvania	20 (18.2)
	No Response	1 (0.9) + *
Primary Residence	Rural	22 (20.0)
	Small Town	52 (47.3)
	Urban	10 (9.1)
	Suburban	26 (23.6)

* One subject was missing all data and was excluded

health-major students of PennWest University in October and November of 2023. The filled-out questionnaires were collected, and their data were analyzed. To compare these characteristics among subgroups, we used the Student's t test for continuous variables and the chi-square test to compare the proportion of participants who agree or strongly agree with each sentence vs. those who disagree or strongly disagree with each sentence with a significant level of 0.05.

Results

The qualitative study

After sharing each question with the participants, the answers and discussions, including the follow-up questions and answers, continued until the point of saturation. The viewpoints shared by the participants were used in developing the questionnaire in the next phase of the study.

Question 1: What branches of CIM are you familiar with or have heard about? The participants mentioned various branches of CIM. The answers included Chiropractic Care (multiple students), Massage Therapy (multiple students), Acupuncture (multiple students), Dry needling, Dietary Supplements (multiple students), Naturopathic Medicine, Essential Oils, Cool Sculpting, Cupping, Yoga (multiple students), Meditation, and Breathwork.

The focus group was continued by a number of follow-up questions regarding specific branches of CIM:

Question 2: Have you had any experiences or encounters with homeopathy? Some students stated they had heard about homeopathy. Nobody reported a personal experience. Quotes from the participants: "I could be off, but it sounds like an annual flu shot. Is that along the lines?" and "I've heard of people using breast milk on their skin."

Question 3: Have you heard of energy healing, such as Reiki? Similar to the previous question, some students expressed familiarity with this method. However, nobody reported a personal experience. A student mentioned that if it is culturally based, then it is more acceptable, but they wouldn't "go for it" otherwise. Another student asked if preachers asking for money to be healed counted as this type of healing. Another student mentioned that many of these techniques could induce the placebo effect and that it can play a large part if they think they can get better. Another student noted that the capitalism of medicine could be the motive for implicating these techniques. Quote: "I've heard about it, but I'm not very scientifically minded, so I have not bothered to look into it."

Question 4: Have you personally, or know anyone close to you, used CIM treatment or care? Most of the participants had personal encounters with CIM treatments. A student explained that she and her mother get chiropractic care as well as massage therapy. She also mentioned that it is helpful since she is an athlete. Another student mentioned that the placebo effect of dry needling helped him feel like he was getting better. He also mentioned that the treatment was encouraged by his coach. Another student mentioned having dry needling but said, "It did not do much for me personally; it was more of a mental thing." Another student mentioned that they and their family have had experience with chiropractic care, yoga, and essential oils. Another student mentioned receiving chiropractic services for the last twenty years due to scoliosis, which has improved from treatment. Another student mentioned that her sister's boyfriend has degenerative disc disease and did not find any relief through conventional medicine but found relief with needling. Another student mentioned that they have personally used

meditation, yoga, and sound meditation. Another student mentioned that many of their dementia patients really enjoy doing yoga because it relaxes them. Another student mentioned that he tried hypnosis on himself, and it worked. Another student mentioned that they do breathwork. Quotes: "My uncle goes to a chiropractor but always has to go back every few weeks and says it is a load of BS," and "I do not have any experience with CIM, but I do have many family members and people close to them who say yoga has greatly improved their lives."

Question 5: Explain your experience with CIM, including its perceived benefits and harm. The participants attributed various benefits and harms to the branches of CIM with which they were familiar. A student mentioned that chiropractic care can help people injured in car accidents by eliminating pain. They also mentioned that it can be harmful if the chiropractor is inexperienced or bad at it. Another student mentioned that they had an issue with their back, and massage therapy and chiropractic care were beneficial. Another student mentioned a dead janitor who was cured of chiropractic adjustments. They also mentioned an incident in which a chiropractor ruptured a patient's artery in their neck, and they died. Another student mentioned that it can be harmful if a sick patient believes only in CIM medicine over conventional medicine, which is necessary. Another student mentioned that if a type of CIM can induce a placebo effect, it is helpful and beneficial to the patient. Another student mentioned how age can influence how beneficial CIM can be versus conventional medicine. They mentioned that typically, someone who is very old would more likely use CIM over conventional medicine. Another student mentioned that dietary supplements have many health risks because they are not regulated. Quotes: "Some chiropractors just go through the motions and can do more harm than good to the body." And "99% of the time, a pill will help more than just holding your hand over something."

Question 6: What is the importance of knowing about different branches of CIM for health sciences and healthcare students? All the participants believed that such knowledge is of crucial importance. A student mentioned that they think that if a healthcare provider is going to mention any CIM, they should be fully educated on the subject. Another student mentioned that CIM's effective and ineffective practices should be included in the curriculum. Another student mentioned that it is important to spend time on the health benefit outcomes that have been proven. They also mentioned that practices that are not research-based should not be included. Another student mentioned that different cultural practices should be considered for appropriateness. Another student mentioned that there should be courses regarding over-the-counter supplements. Quotes: "I definitely feel that it should be more included in medical schools" and, "I think the worst thing a doctor can do is offer false hope to a patient by recommending a practice that they do not know enough about."

The quantitative study

The questionnaire was sent to 255 health-majoring students from all three campuses of PennWest University. The list was not comprehensive. 111 students filled out and returned the questionnaire (Response Rate = 44%).

Table 1 shows the demographic data of the respondents. We did not receive any completed questionnaire from the California campus. The data shows that the respondents were diverse in terms of age, gender, academic year, and area of residence (see Table 1). Most of the participants (89 [80.9%]) live in the state of Pennsylvania. Their primary residences were distributed among rural, urban, suburban, and small-town areas of the state.

Table 2 shows the answers about the participants' familiarity with various branches of CIM. Ninety-two (83.6%) of participants stated that they were familiar with one or more branches of CIM, with Chiropractic ranked highest in the number of participants (84 [76.4%]) who stated familiarity with it. Also, 86 (78.2%) of participants stated that they had personally used CIM, and 90 (81.8%) of them knew other persons among their friends and family members who used CIM. Again, Chiropractic ranked highest among various branches of CIM.

Table 3 summarizes the answers to the Likert-scale questions (the number and proportion of participants who agree or strongly agree with each sentence vs. those who disagree or strongly disagree). Most participants stated they were not satisfied with their current knowledge of CIM. This dissatisfaction did not significantly differ among genders or academic years.

A significantly higher number of the participants agreed or strongly agreed that "they did not receive education about CIM in high school or college" and "it is necessary for healthcare providers to have sufficient knowledge of CIM."

A significant majority of the participants showed favorable attitudes toward CIM. For instance, the percentages of the participants who strongly agreed or agreed with statements such as "At least some branches of CIM represent valid forms of medicine that can treat a wide variety of diseases," "Patients benefit from physicians who practice CIM," and "I want to use CIM for my patients if I become a healthcare provider," were significantly higher that the percentages of the ones who disagreed or strongly disagreed with them (Table 3).

Discussion

The distribution and diversity of our respondents in terms of residence location, gender, and academic year show that we have a representative sample of health-major students from Western Pennsylvania who will shape the next generation of healthcare providers in this area.

A systematic review of 21 published empirical studies on nurses' knowledge, attitudes, and practices regarding complementary and integrative therapies showed that 65.9% of the nurses reported using CAM (Complementary and Alternative Medicine; please see the introduction above) therapies with patients (Balouchi et al. 2018). Those 21 studies were conducted in different countries. Therefore, it is evidence of the widespread popularity of CIM among healthcare providers. At the same time, this systematic review showed the perceived lack of training among the respondents in various countries (Balouchi et al. 2018). Another study conducted in Iran in 2013 assessed the knowledge, attitude, and practice of physicians who practice as general practitioners. In this study, 79.2% of the responders had noticed

Table 2 Answers to questions about familiarity with CIM

Question	General		Chiropractic		Massage Therapy		Acupuncture		Dry needling		Naturopathic Medicine	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Are you familiar with any branch, type, or practice of medicine that presents itself as Complementary, Alternative, or Integrative Medicine (CIM)?	92 (83.6)	18 (16.4)	84 (76.4)	26 (23.6)	66 (60)	44 (40)	61 (55.5)	49 (44.5)	12 (10.9)	98 (89.1)	12 (10.9)	98 (89.1)
Have you ever used any branch of CIM?	86 (78.2)	24 (21.8)	54 (49.1)	56 (50.9)	25 (22.7)	85 (77.3)	2 (1.8)	108 (98.2)	1 (0.9)	109 (99.1)	1 (0.9)	109 (99.1)
Do you know anybody among your friends or family that have ever used any branch of CIM?	90 (81.8)	20 (18.2)	73 (66.4)	37 (33.6)	40 (36.4)	70 (63.6)	11 (10)	99 (90)	1 (0.9)	109 (99.1)	5 (4.5)	105 (95.5)

Question	Essential Oils		Cupping		Yoga		Meditation		Breath work		Other	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Are you familiar with any branch, type, or practice of medicine that presents itself as Complementary, Alternative, or Integrative Medicine (CIM)?	64 (58.2)	46 (41.8)	59 (53.6)	51 (46.4)	73 (66.4)	37 (33.6)	69 (62.7)	41 (37.3)	44 (40)	66 (60)	6 (5.5)	104 (94.5)
Have you ever used any branch of CIM?	37 (33.6)	73 (66.4)	16 (14.5)	94 (85.5)	43 (39.1)	67 (60.9)	26 (23.6)	84 (76.4)	20 (18.2)	90 (81.8)	4 (3.6)	106 (96.4)
Do you know anybody among your friends or family that have ever used any branch of CIM?	42 (38.2)	68 (61.8)	21 (19.1)	89 (80.9)	41 (37.3)	69 (62.7)	24 (21.8)	86 (78.2)	18 (16.4)	92 (83.6)	2 (1.8)	108 (98.2)

Table 3 Answers to the Likert-scale questions (number and proportion of participants who agree or strongly agree with each sentence vs. disagree or strongly disagree)

#	Question		Age			Gender			Major			Minor			
			18–19 n (%)	>=20 n (%)	P Value	Male n (%)	Female n (%)	P Value	Health Sciences n (%)	Nursing n (%)	P Value	No Minor n (%)	Psychology n (%)	Biology n (%)	P
1	I feel satisfied with my current knowledge of CIM.	Disagree	15 (30.6)	17 (27.9)	0.8	2 (15.4)	29 (30.2)	0.1	9 (37.5)	22 (27.5)	0.09	19 (30.6)	4 (21.1)	5 (29.4)	0.3
		Agree	20 (40.8)	29 (47.5)		9 (69.2)	40 (41.7)		6 (25)	40 (50)		26 (41.9)	7 (36.8)	10 (58.8)	
2	Most CIM therapies stimulate the body's natural therapeutic powers.	Disagree	2 (4.1)	4 (6.6)	0.01	3 (23.1)	3 (3.1)	0.009	2 (8.3)	4 (5)	0.2	2 (3.2)	1 (5.3)	2 (11.8)	0.1
		Agree	31 (63.3)	51 (83.6)		9 (69.2)	73 (76)		14 (58.3)	62 (77.5)		43 (69.4)	14 (73.7)	15 (88.2)	
3	I received education about CIM in high school or college.	Disagree	33 (67.3)	26 (42.6)	0.03	7 (53.8)	52 (54.2)	0.8	17 (70.8)	41 (51.2)	0.1	40 (64.5)	10 (52.6)	2 (11.8)	0.002
		Agree	11 (22.4)	27 (44.3)		4 (30.8)	34 (35.4)		4 (16.7)	31 (38.8)		15 (24.2)	8 (42.1)	12 (70.6)	
4	I have acquired knowledge about CIM through reading books or using other educational materials.	Disagree	24 (49)	21 (34.4)	0.01	5 (38.5)	40 (41.7)	0.9	9 (37.5)	34 (42.5)	0.4	27 (43.5)	9 (47.4)	4 (23.5)	0.5
		Agree	17 (34.7)	37 (60.7)		7 (53.8)	47 (49)		14 (58.3)	36 (45)		28 (45.2)	9 (47.4)	11 (64.7)	
5	Most CIM therapies have been tested and approved by scientific methodology.	Disagree	7 (14.3)	12 (19.7)	0.5	8 (61.5)	11 (11.5)	0.001	5 (20.8)	12 (15)	0.5	10 (16.1)	2 (10.5)	3 (17.6)	0.2
		Agree	14 (28.6)	21 (34.4)		4 (30.8)	31 (32.3)		5 (20.8)	27 (33.8)		16 (25.8)	7 (36.8)	9 (52.9)	
6	CIM is popular in the area of my primary residence.	Disagree	15 (30.6)	17 (27.9)	0.5	3 (23.1)	29 (30.2)	0.8	10 (41.7)	20 (25)	0.9	20 (32.3)	7 (36.8)	3 (17.6)	0.3
		Agree	16 (32.7)	26 (42.6)		5 (38.5)	37 (38.5)		8 (33.3)	31 (38.8)		20 (32.3)	9 (47.4)	8 (47.1)	
7	Patients benefit from physicians who practice CIM.	Disagree	1 (2)	0 (0)	0.1	0 (0)	1 (1)	0.9	0 (0)	1 (1.3)	0.3	0 (0)	0 (0)	1 (5.9)	0.1
		Agree	31 (63.3)	49 (80.3)		10 (76.9)	70 (72.9)		17 (70.8)	57 (71.3)		42 (67.7)	14 (73.7)	14 (82.4)	

Table 3 (continued)

#	Statement		C1	C2	p	C3	C4	p	C5	C6	p	C7	C8	C9	p
8	At least some branches of CIM represent valid forms of medicine that can treat a wide variety of diseases.	Disagree	9 (18.4)	4 (6.6)	0.03	2 (15.4)	11 (11.5)	0.4	4 (16.7)	9 (11.3)	0.8	8 (12.9)	0 (0)	2 (11.8)	0.07
		Agree	17 (34.7)	35 (57.4)		8 (61.5)	44 (45.8)		10 (41.7)	37 (46.3)		24 (38.7)	10 (52.6)	12 (70.6)	
9	CIM is a threat to public health.	Disagree	41 (83.7)	53 (86.9)	0.7	10 (76.9)	84 (87.5)	0.01	21 (87.5)	67 (83.8)	0.7	51 (82.3)	16 (84.2)	15 (88.2)	0.7
		Agree	2 (4.1)	1 (1.6)		2 (15.4)	1 (1)		1 (4.2)	2 (2.5)		2 (3.2)	0 (0)	1 (5.9)	
10	The benefits of CIM are because of the placebo effect.	Disagree	20 (40.8)	31 (50.8)	0.1	6 (46.2)	45 (46.9)	0.2	9 (37.5)	38 (47.5)	0.4	28 (45.2)	8 (42.1)	11 (64.7)	0.2
		Agree	8 (16.3)	3 (4.9)		3 (23.1)	8 (8.3)		4 (16.7)	6 (7.5)		4 (6.5)	2 (10.5)	3 (17.6)	
11	At least some branches of CIM are beneficial supplements to conventional medicine.	Disagree	5 (10.2)	1 (1.6)	0.1	2 (15.4)	4 (4.2)	0.2	2 (8.3)	4 (5)	0.8	4 (6.5)	0 (0)	1 (5.9)	0.5
		Agree	25 (51)	36 (59)		8 (61.5)	53 (55.2)		12 (50)	44 (55)		36 (58.1)	9 (47.4)	11 (64.7)	
12	Courses about CIM should be included in undergraduate health-related programs, such as nursing and pre-medicine.	Disagree	6 (12.2)	3 (4.9)	0.3	0 (0)	9 (9.4)	0.5	3 (12.5)	6 (7.5)	0.7	5 (8.1)	1 (5.3)	1 (5.9)	0.7
		Agree	35 (71.4)	51 (83.6)		11 (84.6)	75 (78.1)		18 (75)	63 (78.8)		48 (77.4)	14 (73.7)	15 (88.2)	
13	Courses about CIM should be included in graduate health-related programs, such as nursing and medicine.	Disagree	7 (14.3)	2 (3.3)	0.06	1 (7.7)	8 (8.3)	0.9	5 (20.8)	4 (5)	0.05	5 (8.1)	1 (5.3)	1 (5.9)	0.3
		Agree	33 (67.3)	51 (83.6)		10 (76.9)	74 (77.1)		15 (62.5)	63 (78.8)		47 (75.8)	13 (68.4)	16 (94.1)	
14	Insurance companies should cover CIM.	Disagree	4 (8.2)	2 (3.3)	0.01	1 (7.7)	5 (5.2)	0.9	2 (8.3)	4 (5)	0.7	4 (6.5)	1 (5.3)	1 (5.9)	0.2
		Agree	25 (51)	47 (77)		9 (69.2)	63 (65.6)		16 (66.7)	51 (63.7)		38 (61.3)	11 (57.9)	12 (70.6)	

Table 3 (continued)

#	Statement	Response	n (%)	n (%)	P	n (%)	n (%)	P	n (%)	n (%)	P	n (%)	n (%)	n (%)	P
15	The government should support research on CIM.	Disagree	3 (6.1)	1 (1.6)	0.1	1 (7.7)	3 (3.1)	0.3	1 (4.2)	3 (3.8)	0.7	3 (4.8)	0 (0)	1 (5.9)	0.5
		Agree	30 (61.2)	48 (78.7)		11 (84.6)	67 (69.8)		18 (75)	54 (67.5)		40 (64.5)	14 (73.7)	14 (82.4)	
16	The government should support the practice of CIM.	Disagree	2 (4.1)	2 (3.3)	0.6	2 (15.4)	2 (2.1)	0.06	2 (8.3)	2 (2.5)	0.4	2 (3.2)	1 (5.3)	1 (5.9)	0.8
		Agree	30 (61.2)	43 (70.5)		8 (61.5)	65 (67.7)		14 (58.3)	54 (67.5)		39 (62.9)	12 (63.2)	13 (76.5)	
17	I want to use CIM for my patients if I become a healthcare provider.	Disagree	3 (6.1)	2 (3.3)	0.007	1 (7.7)	4 (4.2)	0.2	2 (8.3)	3 (3.8)	0.3	2 (3.2)	2 (10.5)	1 (5.9)	0.1
		Agree	19 (38.8)	42 (68.9)		10 (76.9)	51 (53.1)		10 (41.7)	46 (57.5)		29 (46.8)	11 (57.9)	13 (76.5)	
18	Patients should have the right to choose between CIM and conventional medicine.	Disagree	3 (6.1)	1 (1.6)	0.4	0 (0)	4 (4.2)	0.2	1 (4.2)	3 (3.8)	0.9	2 (3.2)	0 (0)	1 (5.9)	0.4
		Agree	40 (81.6)	51 (83.6)		13 (100)	78 (81.3)		19 (79.2)	67 (83.8)		54 (87.1)	14 (73.7)	13 (76.5)	
19	It is necessary for healthcare providers to have sufficient knowledge of CIM.	Disagree	3 (6.1)	2 (3.3)	0.002	0 (0)	5 (5.2)	0.4	3 (12.5)	1 (1.3)	0.03	2 (3.2)	0 (0)	2 (11.8)	0.06
		Agree	31 (63.3)	55 (90.2)		12 (92.3)	74 (77.1)		16 (66.7)	65 (81.3)		45 (72.6)	17 (89.5)	15 (88.2)	

#		Campus			Academic Year					Primary Residence					Primary Residence		
		Edinboro n (%)	Clarion n (%)	P	Freshman n (%)	Sophomore n (%)	Junior n (%)	Senior n (%)	P	Rural n (%)	Urban n (%)	Suburban n (%)	Small Town n (%)	P	In Pennsylvania n (%)	Outside Pennsylvania n (%)	P
1	Disagree	22 (27.8)	10 (32.3)	0.2	8 (25.8)	6 (27.3)	7 (30.4)	10 (30.3)	0.9	5 (22.7)	16 (30.8)	2 (20)	9 (34.6)	0.7	23 (25.8)	9 (45)	0.1
	Agree	36 (45.6)	13 (41.9)		13 (41.9)	11 (50)	9 (39.1)	16 (48.5)		12 (54.5)	24 (46.2)	5 (50)	8 (30.8)		44 (49.4)	5 (25)	
2	Disagree	6 (7.6)	0 (0)	0.5	2 (6.5)	0 (0)	3 (13)	1 (3)	0.06	1 (4.5)	2 (3.8)	1 (10)	2 (7.7)	0.6	4 (4.5)	1 (5)	0.2
	Agree	58 (73.4)	24 (77.4)		18 (58.1)	18 (81.8)	18 (78.3)	28 (84.8)		17 (77.3)	39 (75)	5 (50)	21 (80.8)		70 (78.7)	12 (60)	
3	Disagree	40 (50.6)	19 (61.3)	0.7	21 (67.7)	14 (63.6)	10 (43.5)	14 (42.4)	0.3	11 (50)	28 (53.8)	7 (70)	13 (50)	0.6	44 (49.4)	15 (75)	0.1
	Agree	29 (36.7)	9 (29)		8 (25.8)	5 (22.7)	9 (39.1)	16 (48.5)		9 (40.9)	15 (28.8)	3 (30)	11 (42.3)		35 (39.3)	3 (15)	

Table 3 (continued)

4	Disagree	33 (41.8)	12 (38.7)	0.2	18 (58.1)	7 (31.8)	9 (39.1)	11 (33.3)	0.2	8 (36.4)	25 (48.1)	3 (30)	9 (34.6)	0.8	37 (41.6)	8 (40)	0.2
	Agree	39 (49.4)	15 (48.4)		9 (29)	12 (54.5)	14 (60.9)	19 (57.6)		12 (54.5)	20 (38.5)	7 (70)	15 (57.7)		42 (47.2)	12 (60)	
5	Disagree	15 (19)	4 (12.9)	0.4	4 (12.9)	4 (18.2)	5 (21.7)	6 (18.2)	0.9	5 (22.7)	6 (11.5)	2 (20)	6 (23.1)	0.4	12 (13.5)	7 (35)	0.06
	Agree	27 (34.2)	8 (25.8)		10 (32.3)	6 (27.3)	8 (34.8)	11 (33.3)		7 (31.8)	17 (32.7)	4 (40)	7 (26.9)		31 (34.8)	4 (20)	
6	Disagree	23 (29.1)	9 (29)	0.8	10 (32.3)	6 (27.3)	7 (30.4)	9 (27.3)	0.8	9 (40.9)	16 (30.8)	0 (0)	7 (26.9)	0.4	26 (29.2)	6 (30)	0.9
	Agree	32 (40.5)	10 (32.3)		9 (29)	8 (36.4)	9 (39.1)	16 (48.5)		7 (31.8)	19 (36.5)	5 (50)	11 (42.3)		33 (37.1)	8 (40)	
7	Disagree	1 (1.3)	0 (0)	0.2	1 (3.2)	0 (0)	0 (0)	0 (0)	0.3	0 (0)	0 (0)	0 (0)	1 (3.8)	0.3	1 (1.1)	0 (0)	0.6
	Agree	56 (70.9)	24 (77.4)		18 (58.1)	16 (72.7)	18 (78.3)	28 (84.8)		16 (72.7)	39 (75)	5 (50)	20 (76.9)		66 (74.2)	13 (65)	
8	Disagree	11 (13.9)	2 (6.5)	0.007	4 (12.9)	4 (18.2)	0 (0)	5 (15.2)	0.3	1 (4.5)	6 (11.5)	2 (20)	4 (15.4)	0.4	7 (7.9)	5 (25)	0.08
	Agree	43 (54.4)	9 (29)		12 (38.7)	8 (36.4)	14 (60.9)	18 (54.5)		14 (63.6)	20 (38.5)	5 (50)	13 (50)		43 (48.3)	9 (45)	
9	Disagree	68 (86.1)	26 (83.9)	0.9	25 (80.6)	21 (95.5)	19 (82.6)	29 (87.9)	0.5	19 (86.4)	47 (90.4)	6 (60)	22 (84.6)	0.3	77 (86.5)	16 (80)	0.09
	Agree	2 (2.5)	1 (3.2)		1 (3.2)	1 (4.5)	1 (4.3)	0 (0)		0 (0)	1 (1.9)	1 (10)	1 (3.8)		1 (1.1)	2 (10)	
10	Disagree	38 (48.1)	13 (41.9)	0.2	13 (41.9)	7 (31.8)	11 (47.8)	20 (60.6)	0.2	13 (59.1)	23 (44.2)	2 (20)	13 (50)	0.2	40 (44.9)	11 (55)	0.7
	Agree	10 (12.7)	1 (3.2)		3 (9.7)	5 (22.7)	2 (8.7)	1 (3)		1 (4.5)	4 (7.7)	3 (30)	3 (11.5)		9 (10.1)	2 (10)	
11	Disagree	6 (7.6)	0 (0)	0.05	3 (9.7)	2 (9.1)	1 (4.3)	0 (0)	0.4	1 (4.5)	2 (3.8)	1 (10)	2 (7.7)	0.5	3 (3.4)	3 (15)	0.1
	Agree	47 (59.5)	14 (45.2)		14 (45.2)	14 (63.6)	15 (65.2)	18 (54.5)		15 (68.2)	30 (57.7)	3 (30)	13 (50)		49 (55.1)	11 (55)	
12	Disagree	5 (6.3)	4 (12.9)	0.5	2 (6.5)	5 (22.7)	0 (0)	2 (6.1)	0.01	1 (4.5)	5 (9.6)	1 (10)	2 (7.7)	0.7	7 (7.9)	2 (10)	0.8
	Agree	63 (79.7)	23 (74.2)		22 (71)	17 (77.3)	18 (78.3)	29 (87.9)		18 (81.8)	38 (73.1)	7 (70)	23 (88.5)		69 (77.5)	16 (80)	
13	Disagree	7 (8.9)	2 (6.5)	0.7	2 (6.5)	5 (22.7)	0 (0)	2 (6.1)	0.04	0 (0)	4 (7.7)	2 (20)	3 (11.5)	0.03	5 (5.6)	4 (20)	0.1
	Agree	61 (77.2)	23 (74.2)		23 (74.2)	15 (68.2)	17 (73.9)	29 (87.9)		20 (90.9)	36 (69.2)	5 (50)	23 (88.5)		70 (78.7)	13 (65)	
14	Disagree	6 (7.6)	0 (0)	0.2	3 (9.7)	1 (4.5)	1 (4.3)	1 (3)	0.2	1 (4.5)	3 (5.8)	1 (10)	1 (3.8)	0.9	4 (4.5)	2 (10)	0.6
	Agree	49 (62)	23 (74.2)		14 (45.2)	16 (72.7)	18 (78.3)	24 (72.7)		15 (68.2)	34 (65.4)	5 (50)	18 (69.2)		58 (65.2)	13 (65)	
15	Disagree	3 (3.8)	1 (3.2)	0.9	2 (6.5)	2 (9.1)	0 (0)	0 (0)	0.04	0 (0)	2 (3.8)	1 (10)	1 (3.8)	0.4	2 (2.2)	2 (10)	0.2
	Agree	59 (74.7)	19 (61.3)		16 (51.6)	17 (77.3)	17 (73.9)	28 (84.8)		16 (72.7)	35 (67.3)	5 (50)	22 (84.6)		64 (71.9)	13 (65)	
16	Disagree	3 (3.8)	1 (3.2)	0.3	1 (3.2)	2 (9.1)	1 (4.3)	0 (0)	0.2	1 (4.5)	1 (1.9)	1 (10)	1 (3.8)	0.6	3 (3.4)	1 (5)	0.5
	Agree	53 (67.1)	20 (64.5)		17 (54.8)	17 (77.3)	14 (60.9)	25 (75.8)		13 (59.1)	35 (67.3)	5 (50)	20 (76.9)		61 (68.5)	11 (55)	
17	Disagree	5 (6.3)	0 (0)	0.9	2 (6.5)	2 (9.1)	1 (4.3)	0 (0)	0.1	1 (4.5)	2 (3.8)	1 (10)	1 (3.8)	0.8	4 (4.5)	1 (5)	0.9
	Agree	42 (53.2)	19 (61.3)		13 (41.9)	9 (40.9)	16 (69.6)	23 (69.7)		13 (59.1)	26 (50)	5 (50)	17 (65.4)		49 (55.1)	11 (55)	

Table 3 (continued)

18	Disagree	3 (3.8)	1 (3.2)	0.7	2 (6.5)	1 (4.5)	0 (0)	1 (3)	0.7	1 (4.5)	2 (3.8)	0 (0)	1 (3.8)	0.9	3 (3.4)	1 (5)	0.6
	Agree	64 (81)	27 (87.1)		25 (80.6)	20 (90.9)	20 (87)	26 (78.8)		19 (86.4)	44 (84.6)	8 (80)	20 (76.9)		75 (84.3)	15 (75)	
19	Disagree	5 (6.3)	0 (0)	0.3	1 (3.2)	1 (4.5)	1 (4.3)	2 (6.1)	0.04	0 (0)	2 (3.8)	1 (10)	2 (7.7)	0.2	3 (3.4)	2 (10)	0.4
	Agree	62 (78.5)	24 (77.4)		19 (61.3)	17 (77.3)	20 (87)	30 (90.9)		19 (86.4)	37 (71.2)	7 (70)	23 (88.5)		70 (78.7)	15 (75)	

a recent growth in the use of CIM, and 80.1% of them agreed with the necessity of including courses on CIM in the curricula of medical schools (Barikani et al. 2015). The findings of both studies mentioned above concur with our finding of the perceived need for more education regarding CIM among health-majoring students.

Multiple studies have explored the knowledge, attitude, and practice of medical students regarding CIM. A survey published in 2011 showed that medical students in a reputable school in southern California in the United States stated that most of them had used CAM modalities. The modalities ranged from the ones with recreational nature, such as massage, with the highest popularities, to the ones with more therapeutic purpose, such as Ayurveda, with the lowest popularities. Third-year students showed less favorable attitudes toward CAM compared to first-year students. The study concluded that there is a need for more education regarding CAM to be included in the curricula (Desylvia et al. 2011). Two similar studies published in 2015 (Al Mansour et al. 2015) and 2018 (Albadr et al. 2018) showed the popularity of CAM modalities among medical students in Saudi Arabia. A similar study published in 2018 showed similar findings in terms of the popularity of CAM in Jordan and concluded the need for more education on CAM for medical students (Radi et al. 2018). In 2018, Samara et al. (2019) conducted a study to assess the use and acceptance of CAM among medical students in Palestine. Their study showed the popularity of CAM among Palestinian medical students. The most popular branch of CAM among the responders was herbal medicine, with which 79.3% of the students were familiar. Also, social media was the most common source of information regarding CAM for these students. This paper also concluded that there is a knowledge gap regarding CAM among medical students and the necessity of including relevant educational items in the curricula, a conclusion to which most of the responders agreed (Samara et al. 2019). Xie et al. (2020) published the results of a similar study in China. In their study, 87.7% of the students of medical universities and 82.7% of the students of nonmedical universities showed positive attitudes toward incorporating CIM (dubbed CAM in that paper) into the curricula, compared to %67.3 in this study. The most popular branches of CIM in their study among the students to be included in the curricula were Massage, Acupuncture, and Traditional Chinese Medicine (Xie et al. 2020). The difference between the two studies in terms of the popular branches can be explained by different availabilities in their geographic areas. However, both studies show the demand among the students to know more about CIM.

The studies reviewed briefly above and other similar published studies (Liu et al. 2014; Ameade et al. 2016; Lie and Boker 2006; Yeo et al. 2005; Armson et al. 2020) concur with the findings of our study in the following points:

First, they show the popularity and widespread familiarity with and use of various modalities of CAM among health-majoring students in various countries from different continents. Therefore, they all show the importance of this subject in the personal and professional lives of these students who will be future healthcare professionals.

Second, they show no consistent significant differences in the knowledge, attitude, and use of CIM in terms of the respondents' age, gender, years of education, or location of residence. There are, however, some notable exceptions. For example,

in a good medical school, such as UCLA, the students in higher academic years showed less positive attitudes toward CAM (Desylvia et al. 2011).

Third, they all concluded that there is a need for more education on CIM to be included in the curricula.

There are also differences between the results and conclusions of the reviewed studies and this one. First, one can notice the differences between the types of CIM the respondents in various studies are familiar with. Such differences can mainly be attributed to the differences in geographic areas and socio-economic backgrounds. For example, in the study on Palestinian medical students, herbal medicine was most well-known because of the widespread use of such less expensive remedies, especially in the refugee camps (Samara et al. 2019). At the same time, it is unsurprising that Chinese students were more familiar with the branches of CIM that originated from Chinese culture (Xie et al. 2020). In our study, students were more familiar with Chiropractic, which has a strong presence in both urban and rural areas in Western Pennsylvania.

In addition, most of the reviewed studies were conducted by CIM proponents and practitioners and published in journals dedicated to promoting CIM. Therefore, although they concur with the authors of this study in the fact that there is a need for more education on CIM, there may be a major difference as follows: Some of those authors conclude that various branches of CIM should be taught to the student as valid alternative branches of medicine. However, this study argues that education should be comprehensive and science-based. In other words, it should educate the students about the importance of evidence-based practice and the risks of using untested remedies and interventions.

Using science-based medicine in clinical training and practice is an ethical mandate. Using and teaching untested or pseudoscientific theories or treatments is ethically wrong. Therefore, the ethical basis of the mandate to use science-based medicine and avoid pseudoscience should be a part of ethics education for students who pursue a degree in medicine or other health-related professions.

Conclusions

The high rates of encounter with and use of CIM among health-major students shows their need to receive comprehensive and reliable information about its various branches, practices, and claims. Our results show that the students agree with the need for such an education. Also, the favorable attitude of the participants toward CIM can be considered a warning sign because it shows a potential tendency toward using or referring their future patients to untested and sometimes pseudoscientific practices that will be harmful to them. Such a concern provides a stronger ground for the need for science-based education about CIM for health-major students.

In addition, it is an ethical mandate for all clinicians to benefit and avoid harming their patients. The principles of beneficence and nonmaleficence are among the oldest and most consensual principles of biomedical ethics. Such a mandate necessitates that they avoid prescribing or referring their patients to any type of untested and potentially harmful remedies or practices (Li et al. 2018; Aramesh 2021). To

fulfill this ethical responsibility, healthcare providers need to have reliable and sufficient knowledge about different popular branches of CIM and their claims. In addition, they have to be trained to follow the standards of evidence-based medicine.

In addition, the students and health professionals need to have the ethical knowledge and skills to analyze the ethical aspects of using CIM or referring their patients to CIM practitioners. The favorable attitude of the students toward some branches of CIM, as was shown in this study and similar studies in the discussion above, clearly shows that there is a need for ethical education regarding the mandate to use evidence-based treatments and avoid pseudoscience in professional practice and educate the patients and the public about it. This need should be answered through ethics education in academic institutes.

Limitations

In the qualitative part of the study, the objective was to gather information to help in developing the questionnaire. Therefore, the method used, and the results gathered and reported were just aimed at fulfilling that objective. The questions were answered in the quantitative phase with higher accuracy. Therefore, the qualitative part does not follow a rigorous methodology to answer the main. It was just aimed to help to develop a vaslid and reliable questionnaire.

The 44% response rate is one limitation of our study. Since we contacted the students by email, it is possible that our email did not attract their attention. Also, we did not receive any filled questionnaires from the California Campus; therefore, the respondents were from the Edinboro and Clarion campuses of PennWest. Considering that these campuses are about 100 miles away from each other and are located in different counties, they represent the future healthcare providers of a large geographic area in western Pennsylvania. In addition, as described in the results, the respondents were a diverse group in various terms, including gender and residence location.

Suggestions

The results of this study clearly show the need for valid and science-based education about various aspects of CIM for health-majoring students. They continue to encounter CIM providers, customers, and claims in their personal and professional lives. Their future patients will ask them about CIM, and they will face the question of referring their patients to CIM providers or recommending that they not do so. Therefore, they need valid and reliable knowledge about CIM as a part of their pre-professional and professional education. This study suggests adding courses on different branches of CIM, especially the locally popular ones, to the curricula of health-related disciplines.

More importantly, this study suggests adding the following items to the ethics curricula of the medical and other health-related professional academic programs: A comprehensive ethical education on the necessity of avoiding medical

pseudoscience and untested remedies and following the standards of evidence-based medicine, the knowledge of how to differentiate scientific medicine from pseudoscientific claims, and the knowledge and skills of discussion the issue with the patients in a way to encourage them to share the information about the possible use of CIM with their health providers and educate them about the danger of using pseudoscientific measures.

Declarations

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