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## ORIGINAL ARTICLE

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### Knowledge, attitudes and perceived behavioral modification of chiropractic students returning to clinical training in South Africa amid the COVID-19 pandemic

Laura M. O'Connor, MTech Chiropractic and Christopher Yelverton, MTech Chiro (SA)

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#### ABSTRACT

**Objective:** The purpose of this study was to determine the knowledge and attitudes toward COVID-19 and perceived behavioral modification of South African chiropractic students returning to clinical training during the COVID-19 pandemic.

**Methods:** An online survey was administered to students registered for clinical training in South African chiropractic programs. The survey consisted of questions related to knowledge and attitudes toward COVID-19 and perceptions on behavioral modification in the form of personal protective equipment (PPE) use to prevent transmission.

**Results:** Out of 129 participants, there was a 69% response rate ( $n = 89$ ), with a mean age of  $25 (\pm 2.39)$  years and 75% were females. They had an acceptable level of knowledge (67.9%). There was a favorable perception score about COVID-19 (98.8%) but a poor perception of the role of PPE. They expressed concern about returning to clinical training (62.9%) but were prepared to return to serve their patients during the pandemic (72%).

**Conclusion:** Chiropractic students within South Africa demonstrated good attitudes, knowledge, and perception toward the measures required to return safely to the clinical environment during the COVID-19 pandemic. There was a level of stress associated with potential infection by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), mostly for onward transmission to family members.

**Key Indexing Terms:** Chiropractic; Student; COVID-19; Knowledge; Attitudes; Behavior

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#### INTRODUCTION

At the end of 2019, there was an outbreak of a novel respiratory infection in Wuhan City, China. The infection resulted from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the pandemic was named COVID-19. This infection has spread across the globe, being classified as a pandemic by the World Health Organization in 2020.<sup>1</sup> In response, many countries enforced lockdown restrictions with businesses and places of learning closed to mitigate the spread of infection. There was widespread mental distress as people worried about the dangers of contracting COVID-19.<sup>2,3</sup> Health care workers were particularly susceptible through their direct patient contact,<sup>4</sup> as the virus is easily spread through human-to-human transmission.<sup>5</sup> This highlighted the need for proper education, personal protective equipment (PPE), and good hygiene practices. Regulatory bodies

issued guidelines to prevent transmission of the virus in health care settings,<sup>6,7</sup> however, the best method of protection was prevention. In order for health care workers to protect themselves, they were required to modify their behavior and implement correct PPE usage.<sup>8</sup>

The higher education system was affected by the pandemic. Universities closed their doors and programs moved to online delivery. In health care training programs, whether traditional or complementary, the need for continued clinical training was an issue and required swift action to avoid students delaying their clinical requirements to meet university and regulatory board standards.

In South Africa, unlike traditional medical programs where students have hospital placements, chiropractic students obtain clinical training at on-campus chiropractic clinics.<sup>9,10</sup> These clinics provide a public service delivering chiropractic treatment to local communities at a reduced rate. Chiropractors, unlike medical doctors, generally have longer consultations and their treatments require hands on, manual therapy application—increasing the human-to-human contact. Distress was caused by growing fears of

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contracting the virus and financial fears due to socioeconomic costs of lockdown measures, nightmares, and intrusive thoughts about the virus.<sup>2</sup>

It was deemed necessary to undertake an assessment of the knowledge and attitudes of chiropractic students toward COVID-19, and the perceived behavioral modification that they would undertake on returning to clinical practice in South Africa amid the COVID-19 pandemic.

## METHODS

### Setting and Participants

A cross-sectional, online survey was administered from June to August 2020, during South Africa's first wave of COVID-19 infections. This was an ideal time to conduct the survey as chiropractic clinical training was returning to campuses after the initial lockdown period instituted by the government. There were 129 students registered for clinical training in the 2 universities that provide chiropractic education in South Africa—the Durban University of Technology ( $n = 70$ ) and the University of Johannesburg ( $n = 59$ ). Ethical approval was obtained from both the Durban University of Technology and the University of Johannesburg's Institutional Research and Ethics Committees (IREC 057/20; REC-01-11-2020). Students were assured that they would face no adverse effects should they choose not to partake and were informed that the survey was anonymous.

Recruitment took place via an email that was circulated inviting participation and through class WhatsApp messenger (Meta Platforms, Inc, Menlo Park, CA, USA) groups. A link to the electronic survey was provided. Reminder emails/WhatsApp messages were sent via class representatives.

### Survey Tool

Surveys from Bhagavathula et al<sup>4</sup> and Shi et al<sup>11</sup> were utilized to construct a survey that consisted of 36 questions covering student's demographic characteristics, knowledge, perception, and attitude questions related to COVID-19 and PPE behavioral modifications.

Pilot testing was conducted by having 3 recent graduates from each institution plus 1 faculty member complete the questionnaire. This ensured that the research population could relate to the survey, and to determine if there were any oversights or discrepancies evident in the questionnaire.<sup>12</sup> The survey took on average 10 minutes to complete and was administered using online survey software from QuestionPro, Inc (QuestionPro, Inc, Dallas, TX, USA).

### Knowledge Domain

The knowledge was assessed by questions focusing on COVID-19 etiology, signs and symptoms, transmission, and risk prevention. A knowledge score was calculated by allocating a score of "1," if correct and a score of "0," if incorrect. Scores ranged from 1 to 7. A cut-off level of  $\leq 4$  was considered to indicate poor knowledge about COVID-19, whereas  $>4$  was considered adequate knowledge about COVID-19.<sup>4</sup> The Likert-scale responses for the knowledge

**Table 1 - Demographic Characteristics of Respondents**

Characteristic	n (%)
Sex	
Female	67 (75)
Male	22 (25)
Age	
22–25	62 (70.5)
26–29	20 (22.7)
30+	6 (6.8)
M ( $\pm$ SD)	25 ( $\pm$ 2.4)
Accommodation	
Live alone	7 (7.9)
Live with family/other people with children	17 (19.1)
Live with family/other people excluding children	64 (71.9)
Other	1 (1.1)

questions were dichotomized into 'completely agree/agree' versus 'neither agree nor disagree/disagree/completely disagree' and expressed in proportions.<sup>11</sup>

### Perception Domain

Questions relating to the perception of COVID-19 were modified from Bhagavathula et al.<sup>4</sup> From this survey, 1 question was removed because there are no "wet markets" in South Africa. The 6 true and false items were either labeled as good (scored of "1") or poor (scored of "0") perception. This resulted in scores ranging from 0 to 6. The participants' perceptions were classified as having a good perception if they scored more than 4 and a poor perception if they scored 4 or less.

### Attitude to Behavioral Modification

Attitudes of the participant to using PPE and hygiene practices amid the COVID-19 pandemic were determined using Likert-scale responses. The responses were dichotomized into 'completely agree/agree' versus 'neither agree nor disagree/disagree/completely disagree' and expressed in proportions.<sup>11</sup>

### Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics version 27 (IBM Corporation, Armonk, NY, USA). The level of the students' knowledge, perception, attitudes, and preparedness to change behavior were determined by frequency distribution. Fisher exact tests were used to determine relationships between the knowledge and perceptions score relative to sex and age. A  $p$  value of less than 0.05 was considered significant.

## RESULTS

There was a 69% response rate ( $n = 89$ ). The sociodemographic characteristics are presented in Table 1. The students had an average age of 25 years ( $\pm 2.39$ ; range, 22–33) with a female preponderance (75%). Most students resided with their families with no children in the home (71.9%).

**Table 2 - Sources of Information for COVID-19 Utilized by the Students**

Medium	Never, n (%)	Least used, n (%)	Sometimes, n (%)	More often, n (%)	Most used, n (%)
News and Media (TV, radio, newspapers)	1 (1.2)	8 (9.4)	16 (18.8)	23 (27.1)	37 (43.5)
Social media (eg, Facebook, Twitter, WhatsApp, YouTube, Instagram, Snapchat)	12 (13.5)	19 (21.3)	19 (21.3)	19 (21.3)	20 (22.5)
Official government websites	7 (7.9)	9 (10.1)	27 (30.3)	20 (22.5)	26 (29.2)
Family member, colleague or friend	5 (5.6)	32 (36.0)	33 (37.1)	14 (15.7)	5 (5.6)
Scientific sources	14 (15.9)	23 (26.1)	18 (20.5)	22 (25.0)	11 (12.5)

**Knowledge of COVID-19**

All the respondents had heard of COVID-19 ( $n = 89$ ; 100%) with 82% ( $n = 73$ ) having attended a lecture or discussion on COVID-19. Table 2 shows the variety of

**Table 3 - Participant Responses to the Knowledge Questions About the Novel Coronavirus**

Knowledge of Novel Coronavirus	n (%)
Incubation period of novel coronavirus:	
2–7 days	3 (3.5)
2–14 days <sup>a</sup>	42 (48.8)
7–14 days	33 (38.4)
7–21 days	7 (8.1)
None of the above	1 (1.2)
Symptoms of novel coronavirus are all except:	
Headache	3 (3.5)
Fever	2 (2.3)
Sore throat and runny nose	1 (1.2)
Skin rash <sup>a</sup>	78 (90.7)
Loss of smell and taste	2 (2.3)
Novel coronavirus origin is thought to be from:	
Bats <sup>a</sup>	67 (77.9)
Snakes	1 (1.2)
Fish	1 (1.2)
Unknown	17 (19.8)
Novel coronavirus transmission occurs through:	
Air	22 (25.6)
Contact	29 (33.7)
Fecal-oral	1 (1.2)
All the above <sup>a</sup>	29 (33.7)
None of the above	5 (5.8)
What are the complications of novel coronavirus?	
Pneumonia	4 (4.7)
Respiratory failure	10 (11.6)
Death	1 (1.2)
All the above <sup>a</sup>	71 (82.6)
What is the treatment of novel coronavirus?	
Supportive care <sup>a</sup>	61 (70.9)
Antiviral therapy	9 (10.5)
Anti-malarial medication	4 (4.7)
None of the above	12 (14.0)
How can one reduce the risk of transmission?	
Hand hygiene	8 (9.3)
Covering the nose and mouth when coughing and sneezing	6 (7.0)
Avoiding sick contacts	0 (0.0)
Having well-cooked meat and eggs	0 (0.0)
All of the above <sup>a</sup>	72 (83.7)

<sup>a</sup> Indicates the correct answer.

sources students consulted to obtain information on COVID-19.

Table 3 shows the participant's responses to the knowledge questions. Participants were unclear on the incubation period of novel coronavirus with 51.2% providing the incorrect answer. The majority of respondents identified the symptom that was not related to novel coronavirus (90.7%) with 79.1% correctly identifying that bats were the proposed origin of the disease. Respondents were unclear regarding the mode of transmission of the novel coronavirus (66.3%). Participants had a good understanding of the complications resulting from COVID-19 infection (82.6%), how one could reduce the risk of transmission (83.7%), and its treatment (70.9%). The respondents overall had good knowledge of COVID-19 based on the cumulative knowledge score (67.9%,  $n = 84$ ). Males (86.4%) and younger respondents (75.9%; 25 years of age and below) achieved better knowledge scores than their counterparts ( $p = .035$  and  $p = .042$ , respectively; Table 4).

Table 5 shows the responses to the Likert questions on knowledge. They showed a high level of agreement with all the statements related to COVID-19 and risks for patients and medical staff (91.9%), how to protect themselves and their patients (93.0%), good hand hygiene practices (98.8%), and that they needed to wash their hands not only when visibly soiled (94.1%). Almost all respondents indicated that using the correct PPE did not eliminate the need for good hygiene (96.5%).

The respondents identified that PPE for a chiropractor consisted of face shield (64.2%;  $n = 58$ ), surgical masks (64%;  $n = 57$ ), gloves (29.2%;  $n = 26$ ) followed by cloth masks (25.8%;  $n = 23$ ). N95 masks (23.6%;  $n = 21$ ), gown (18%;  $n = 16$ ), goggles (10.1%;  $n = 9$ ), and apron (9%;  $n = 8$ ) (multiple answers were allowed). Only 22.2% ( $n = 18$ ) selected all of the above as an option for PPE.

**Perceptions of COVID-19**

The respondent's perceptions toward COVID-19 were evaluated by 6 statements indicating either true or false as seen in Table 6. The majority acknowledged that COVID-19 had a good survival rate (97.6%), that meat products could be safely consumed in outbreak areas (95.2%), and that simply just washing ones hands was not enough to guard against contracting the COVID-19 virus (97.6%). All respondents, except 1, had a good perception score when a composite perception score was calculated (98.8%;  $n = 83$ ). There were no significant findings when sex and

**Table 4 - Relationships Between Sex, Age, Knowledge and Perception Scores<sup>a</sup>**

	Total	Knowledge Score			Perception Score		
		Good	Poor	p	Good	Poor	p
Sex							
Female	62 (73.8)	38 (61.3)	24 (38.7)	.035	61 (98.4)	1 (1.6)	1.000
Male	22 (26.2)	19 (86.4)	3 (13.6)		22 (100.0)	0 (0.0)	
Age							
22–25	58 (69.9)	44 (75.9)	14 (24.1)	.042	57 (98.3)	1 (1.7)	1.000
26–29	19 (22.9)	9 (47.4)	10 (52.6)		19 (100.0)	0 (0.0)	
30+	6 (7.2)	3 (50.0)	3 (50.0)		6 (100.0)	0 (0.0)	

<sup>a</sup> Number of respondents varied per row item.

age were assessed relative to the perception scores (Table 4).

### Attitudes Toward Behavioral Modification

The respondent's attitudes toward PPE and behavioral change amid the COVID-19 pandemic are shown in Table 7. There was an overall poor perception toward PPE; they felt that PPE would not keep health care workers and patients from getting COVID-19 (54.9% respectively). They felt PPE was inconvenient to use (73.2%) and that it interfered with patient treatment (66.3%; n = 59). They had an expectation that PPE would be available in the clinic (95.1%) and that the clinician should reprimand the student if they were not using PPE in the facility (92.7%). Respondents felt that they would be compliant with using PPE (97.6%), with 50.2% indicating that they would remove their PPE immediately on leaving a patient room when it was suspected that they had COVID-19.

The respondents were nervous and anxious about coming back to clinical training during the COVID-19 epidemic (62.9%), but 65.9% felt that the university would do all it could to ensure that the students, staff, and patients were protected. Almost all participants (96.3%), felt that the chiropractic department should amend the requirements for clinical training to accommodate time

lost due to COVID-19. More than half of the respondents were willing to treat patients with COVID-19, if given the opportunity (52.4%; n = 43). Those who said “no” (47.6%; n = 39) were concerned about possible infection either of themselves (30.8%; n = 12) or onward transmission to their family members (92.3%; n = 36). The majority of respondents (72%; n = 59) were ready as health care providers to return to clinical training to serve their patients during the pandemic.

## DISCUSSION

The COVID-19 pandemic has had a direct impact on education and training around the world, either directly or indirectly because of measures put in place by governments to stem the spread. Our study shows that students undergoing clinical training within the chiropractic programs in South Africa had high levels of knowledge, with realistic attitudes and perceptions regarding the return to clinical training. These findings are consistent with medical students who were assessed on the same attributes.<sup>13</sup> In 1 of the first studies investigating medical students' knowledge of COVID-19, it was found that the level of knowledge was high, even though the study was conducted within 1 week of the virus being detected in Iran.<sup>14</sup> This

**Table 5 - Respondents Answers to Likert Scale Knowledge Questions About Novel Coronavirus**

Knowledge Questions	Completely Agree, n (%)		Neutral, n (%)	Disagree, n (%)	Completely Disagree, n (%)
	Agree, n (%)	Agree, n (%)			
You are confident that you understand the risks of the COVID-19 epidemic for the patients and medical staff.	46 (53.5)	33 (38.4)	7 (8.1)	0 (0)	0 (0)
You are confident that you understand how to protect yourself and your patients during the COVID-19 epidemic.	49 (57)	31 (36.0)	4 (4.7)	1 (1.2)	1 (1.2)
Hand hygiene includes either washing hands with soap and water or the use of an alcohol-based hand rub.	62 (72.1)	22 (25.6)	1 (1.2)	0 (0)	1 (1.2)
Only wash hands with an alcohol-based hand rub when they are visibly soiled.	2 (2.4)	5 (5.9)	5 (5.9)	23 (27.1)	50 (58.8)
Use of correct PPE eliminates the need for hand hygiene.	2 (2.4)	1 (1.2)	0 (0)	17 (20.0)	65 (76.5)

PPE: personal protective equipment.



**Table 6 - Chiropractic Students' Perceptions Toward COVID-19**

Perception Questions	True, n (%)	False, n (%)
It is believed that symptoms of the COVID-19 may appear in as few as 2 days or as long as 14 after exposure.	82 (97.6)	2 (2.4)
If anyone gets the COVID-19, there is no possibility of survival.	2 (2.4)	82 (97.6)
If anyone has had a flu shot, they are vaccinated against the Novel Coronavirus.	1 (1.2)	83 (98.8)
Even in areas experiencing outbreaks, meat products can be safely consumed if these items are cooked thoroughly.	80 (95.2)	4 (4.8)
If anyone has a fever, cough, dyspnea, and an altered sense of smell/taste, they should be suspected of having COVID.	83 (98.8)	1 (1.2)
As per WHO guidelines for the Novel Coronavirus, you only need to wash your hands when they are visibly dirty.	2 (2.4)	82 (97.6)

WHO: World Health Organization.

contrasts with a Bangladeshi study on general students where the knowledge of COVID-19 was found to be poor.<sup>15</sup> The knowledge base for COVID-19 has changed dramatically since this study was conducted, both in terms of knowledge of the disease and the availability of information. The participants' knowledge was predominantly via media outlets and social media platforms, which could have presented a concern with the predominance of inaccurate information, but in this case most students still demonstrated good knowledge of various aspects of the disease. A similar trend was found in medical students,<sup>16</sup> where 83.4% regularly consulted social media for information. Importantly, in a clinical setting, the knowledge of limiting potential transmission was well understood.

The nature of the chiropractic profession means that, due to the time period and close proximity to patients, that practitioners and students may be at higher risk of transmission. One of the important mitigating factors is the use of PPE. PPE requirements called for behavioral modification. The participants were confident that they would use the necessary PPE on returning to the clinical environment and understood its role. This is consistent with previous research involving medical students.<sup>17</sup> In spite of this understanding, they were not convinced that PPE would be able to prevent transmission of the virus, yet they reported feeling confident that they could protect themselves and their patients. It has been recommended

**Table 7 - Attitudes Toward Personal Protective Equipment (PPE) and Respondent Preparedness for Clinical Practice Amid the COVID-19 Pandemic**

Attitudes and Preparedness	Completely Agree, n (%)	Agree, n (%)	Neither Agree/ Disagree, n (%)	Disagree, n (%)	Completely Disagree, n (%)
Use of PPE will keep health care workers from getting COVID-19.	4 (4.9)	33 (40.2)	23 (28.0)	18 (22.0)	4 (4.9)
Use of PPE will keep patients from getting COVID-19.	4 (4.9)	33 (40.2)	25 (30.5)	16 (19.5)	4 (4.9)
It is inconvenient to use recommended PPE when taking care of patients.	3 (3.7)	19 (23.2)	19 (23.2)	18 (22.0)	23 (28.0)
Use of the recommended PPE interferes with patient treatment and/or nursing care.	4 (4.9)	19 (23.2)	18 (22.0)	33 (40.2)	8 (9.8)
I would expect that all recommended PPE is readily available in the clinic.	56 (68.3)	22 (26.8)	2 (2.4)	1 (1.2)	1 (1.2)
The clinician should reprimand me if I do not use PPE in the clinic.	49 (59.8)	27 (32.9)	5 (6.1)	1 (1.2)	0 (0.0)
You will remove your PPE immediately when you leave the patients room, when you suspect they have COVID-19.	18 (22.0)	22 (26.8)	11 (13.4)	17 (20.7)	14 (17.1)
I believe I will be compliant with the recommended PPE.	53 (64.6)	27 (32.9)	1 (1.2)	0 (0.0)	1 (1.2)
I feel nervous and anxious about coming back to clinical training during the COVID-19 epidemic.	31 (37.8)	25 (30.5)	9 (11.0)	16 (19.5)	1 (1.2)
I have confidence that the university will do all they can to ensure that the students, staff, and patients are protected.	18 (22.0)	36 (43.9)	13 (15.9)	11 (13.4)	4 (4.9)
I feel that the chiropractic department should amend the requirements for clinical training to accommodate time lost due to COVID-19.	62 (75.6)	17 (20.7)	3 (3.7)	0 (0.0)	0 (0.0)
As a health care provider, I am ready to return to clinical training to serve my patients during the COVID-19 pandemic.	27 (32.9)	32 (39.0)	12 (14.6)	7 (8.5)	4 (4.9)

that facilities make use of a PPE monitor to ensure compliance.<sup>8</sup> In the case of chiropractic training clinics, this responsibility could fall on the supervising clinician. This was echoed by the respondents where they supported the role of the clinical staff to reprimand students who were not compliant.

Most of the respondents felt that the institutions had an obligation to ensure a safe environment for their return to clinical practice. These are reasonable expectations. Both institutions developed extensive hygiene and clinic operating protocols to facilitate a safe-as-possible return of staff, students, and patients to the on-campus clinics. PPE was made available to all students, along with additional hazardous waste bins being placed throughout the clinic. Each clinic room was provided with an alcohol spray of at least 70%, and the students were required to comply with specific protocols for sanitization between patients. These behavioral modifications were made in accordance with the Allied Health Professions Council of South Africa guidelines to assist practitioners to prevent infection transmission during the pandemic. In addition, extensive training was provided by the departments through online/face-to-face lectures to prepare the students prior to them being allowed to return to clinical training.

This study was conducted after South Africa's initial response to the pandemic, which was a strict lockdown, starting on March 23, 2020. This was in response to 554 positive cases and no deaths having been reported. The lockdown resulted in all shops, restaurants, and nonessential businesses closing with immediate effect. Nonessential travel and social gatherings were prohibited and restrictions were placed on outdoor activities. The sale of alcohol and cigarettes was banned. The lockdown was the strictest in Africa and 1 of the most restraining in the world.<sup>18</sup> With easing of restrictions, the Minister of Higher Education and Training announced that clinical training of final year students would begin in a phased-in approach starting with the medical students, followed by other disciplines.<sup>19</sup> This announcement may have been met with mixed emotions by the students due to widespread fear of the danger and contagiousness of SARS-CoV-2. This, together with socioeconomic hardship, fears that foreigners were bringing the disease, compulsive symptom checking, and seeking of reassurance, led to many people suffering high levels of distress and maladaptive coping during self-isolation.<sup>2</sup> This distress is evident with many students worrying about their own safety and that of their family members with fears that they would inadvertently transmit the infection to their home environment. Yet despite this climate, most students were ready to return to clinical training and serve their patients. Clinical training is essential in the development of student's professional identity; the interaction with the patient and the clinician allow the student to role model and develop a culture of altruism.<sup>20</sup> By providing training on hygiene and PPE use, the universities equipped the students with the mechanisms to prevent onward transmission and allay their fears. The student counseling departments were also available for individual consultations to assist students. Where a

student's personal circumstances meant that they had an increased risk profile, mechanisms were provided to support the student.

Because of lockdowns and other measures, the respondents expressed concerns about attaining their clinical requirements. In response to this, both institutions submitted requests to the relevant regulatory authorities to amend the requirements to not disadvantage students during the pandemic, but at the same time ensure the quality of the clinical training program. Educational institutions have a dual obligation to regulatory councils and students with regards to clinical training. This can pose a conflict regarding facilitating students' progress and ensuring clinical competency of all graduates. Chiropractic institutions across the globe were concerned about meeting clinical training requirements during restrictions relating from the COVID-19 pandemic.<sup>21</sup> Davies and Browning<sup>22</sup> highlighted that the amendments to clinical training during COVID-19 affected chiropractic education more than in any other area and that it was necessary to, as soon as possible, revert to the pre-COVID-19 status quo. Other curriculum adjustments occurred such as moving the delivery of the chiropractic curriculum to an online environment. These measures ensured that training continued. Inventive strategies were employed by training facilities to ensure the ongoing teaching of manual therapies in the online space.<sup>23</sup> The COVID-19 pandemic accelerated the move to blended learning that was on the agenda for many South African and international universities.

This study highlighted that chiropractic students were knowledgeable about COVID-19 and committed to modifying their behavior to return to clinical training to provide a service to their patients. Universities needed to ensure that adequate training was provided to ensure the students were equipped to ensure their safety and that of their patients and family members.

### Limitations

This study was conducted at a time when the world was still learning about COVID-19. Since then, the available literature on COVID-19 has grown exponentially, and a follow-up study considering what we now know would be a valuable initiative. The way certain questions were phrased may have led the students to being unsure of the appropriate response. Several multiple choice questions included the option of "none of the above" or "all of the above." Recommendations have been made to avoid using these options. The option "all of the above" requires that participants acknowledge that at least 2 options are incorrect and for the option "none of the above" difficulty arises around negative language and logic.<sup>24</sup> At the time of conducting this survey, there were very few studies that were published on students' knowledge, perception, and attitudes toward COVID-19. This study was compiled utilizing 2 prevalidated questionnaires from the available literature and thus these questions were left unchanged to allow for comparison. Future studies should consider removing these options.

## CONCLUSION

This study found that chiropractic students within South Africa demonstrated good knowledge, perception, and attitude to behavior change to allow return to clinical training during the COVID-19 pandemic. Like many other health care professions, chiropractic students were eager to provide health care to their patients during the pandemic. The students were prepared to adhere to COVID-19 protocols; however, they did display distress regarding returning to the clinical environment. This pertained predominantly to transmitting infection to their home environment and the implications that COVID-19 lockdowns had on their ability to complete their clinical training requirements. Follow-up studies should be conducted to determine if the protocols and training that the institutions implemented resulted in effective practice.

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No funding was provided for this research. The authors have no conflicts of interest to declare relevant to this work.

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### About the Authors

Laura O'Connor (corresponding author) is a senior lecturer in the Department of Chiropractic at the Durban University of Technology (Ritson Campus, 11 Ritson Rd, Berea, Durban, 4000, South Africa; lauraw@dut.ac.za). Christopher Yelverton is the head of the Department of Chiropractic at the University of Johannesburg (John Orr Building, 7th Floor, 55 Beit St, Doornfontein, Johannesburg, 2028, South Africa; chrisy@uj.ac.za). This article was received October 14, 2021; revised March 7, 2022 and May 12, 2022; and accepted July 16, 2022.

### Author Contributions

Concept development: LO, CY. Design: LO. Data collection/processing: LO. Analysis/interpretation: LO, CY. Literature search: LO. Writing: LO, CY. Critical review: LO, CY.

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