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A comparative audit of chiropractic geriatric courses taught at 17 English-speaking accredited chiropractic educational programs worldwide

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Introduction: *The objective of this study was to conduct a comparative audit of geriatric courses taught at English-speaking accredited chiropractic educational programs (CEPs) worldwide.*

Methods: *Using purposeful sampling course coordinators or administrators were asked to provide geriatric course outlines. Data on learning objectives, course structures and topical outlines were extracted, with data presented descriptively.*

Results: *Thirty-four CEPs were invited to participate and data sets of 17 CEPs (Australia, Canada, Puerto Rico, United Kingdom and the United States) were analyzed. All course content was delivered by lectures, the majority assessed students with written examinations and assignments and all teaching faculty were chiropractors. The five most taught topics were*

Un audit comparatif des cours de chiropratique gériatrique dispensés dans 17 programmes éducatifs chiropratiques accrédités anglophones à travers le monde.

Introduction: *L'objectif de cette étude était de réaliser un audit comparatif des cours gériatriques dispensés dans des programmes éducatifs chiropratiques accrédités de langue anglaise (PEC) à travers le monde.*

Méthodes: *En utilisant un échantillonnage intentionnel, les coordonnateurs de cours ou les administrateurs ont été invités à fournir des plans de cours en gériatrie. Des données sur les objectifs d'apprentissage, les structures de cours et les plans thématiques ont été extraites, des données étant présentées de manière descriptive.*

Résultats: *Trente-quatre PEC ont été invités à participer et des ensembles de données de 17 PEC (Australie, Canada, Porto Rico, Royaume-Uni et États-Unis) ont été analysés. Tous les contenus de cours ont été dispensés par des conférences, la majorité a évalué les étudiants par des examens écrits et des travaux, et tout le corps professoral était composé de*

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neurological disorders, chiropractic care, cognitive disorders, geriatric assessment and falls.

Conclusion: *We identified consistency between CEPs with respect to course delivery, assessment and faculty but there was a great deal of variability with respect to course topics. Further research to develop core competencies for geriatric chiropractic education is warranted.*

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KEY WORDS: audit, chiropractic, curriculum, education, geriatrics

chiropraticiens. Les cinq sujets les plus enseignés étaient les troubles neurologiques, les soins chiropratiques, les troubles cognitifs, l'évaluation gériatrique et les chutes.

Conclusion: *Nous avons identifié une cohérence entre les PEC en ce qui concerne la livraison des cours, l'évaluation et le corps professoral, mais il y avait une certaine variabilité en ce qui concerne les sujets des cours. Des recherches supplémentaires sont nécessaires en vue de développer les compétences de base en matière d'éducation chiropratique gériatrique.*

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MOTS CLÉS : audit, chiropratique, programme d'études, éducation, gériatrie

Introduction

2005 witnessed a watershed demographic event. For the first time in human history, the number of people over the age of 65 years exceeded the number of people under the age of 15 years in many countries, including Canada.[1] This 'grey tsunami' was the result of dramatic demographic changes, especially lower fertility rates and increasing life expectancy. Increases in life expectancy is attributable to a confluence of events including improvements in sanitation, improvements in nutrition, widespread use of vaccination and strides in the medical management of both historically fatal events (e.g. stroke, heart attack) and progressively debilitating conditions (e.g. cancer, diabetes).

The net effect of these improvements in health promotion and disease prevention initiatives is centenarians being the fasting growing segment of the population in many countries.[2] Undergirding these societal changes is the ageing of the Baby Boomers.

Born between 1946 and 1964 in the post-World War II Allied countries of Canada, Australasia, the United Kingdom and the United States, the Baby Boomers represent upwards of one-third of the population in these countries. Visually, this resulted in both the rectangularization and feminization of population pyramids, the later effect due to increased longevity among women compared to men (Figure 1).[2]

As an example, according to Statistics Canada, as of 2023, 7 million Canadians are over the age of 65 years, representing 18.9% of the population, up from 16.9% in 2016. At the higher end of life expectancy, 11.8% of Canadian are over the age of 85 and a startling 15.9% are over the age of 100.[2] Over the next 30 years, some

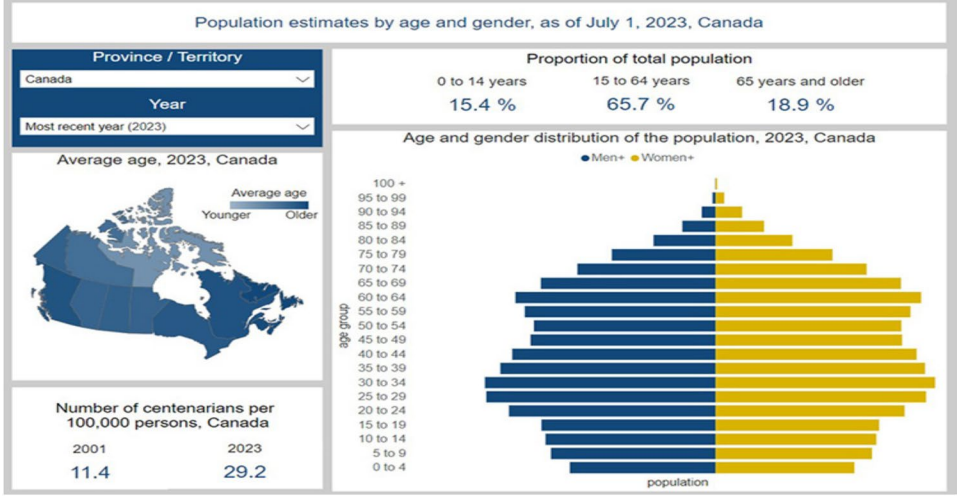

Figure 1.
Population estimates by age and gender, as of July 1, 2023, Canada [2]

of these numbers are expected to triple. Similar demographic trends are seen across developed nations with the percentage of elderly residents even higher in Japan and Southeast Asia due to very low fertility rates.

Research evidence reports older patients are motivated not only to live longer but to live better, to age successfully.[3] From a clinical perspective, this involves maintaining their activities of daily living in order to live independently[4], a key feature of what is referred to as 'active ageing'[5] or, more recently, to 'healthy ageing'[6]. Concurrently, demographic studies investigating practice patterns of community-based chiropractic practices report older patients predominately seek out chiropractic care for neuromusculoskeletal (NMSK) conditions within the scope of chiropractic practice, most commonly spinal pain.[7,8] Spinal pain is the most common cause of disability worldwide and, in regard to low back pain, has a peak prevalence and disability rates in adults from 80 to 85 years of age and is projected to continue to be a significant burden to healthcare in the future.[9] Spinal pain is a condition of healthcare which best aligns with chiropractic's cultural authority.[10,11]

Given these population dynamics and chiropractic practice profiles, a reasonable assumption would be that chiropractic educational programs (CEPs) are allocating considerable time in their curricula to this area of geriatric chiropractic education (GCE). Perhaps there would even be some degree of consistency among CEPs. However, there is evidence to suggest these assumptions are misplaced.

Accreditation boards, councils or agencies (hereafter collectively referred to as 'accrediting agencies') set quality standards in the form of minimal key, enabling or meta-competencies that educational programs must meet.[12-15] The intent of healthcare accrediting agencies is to provide guidance in informing a program's curricular content with the requisite knowledge, skills, attitudes and values that enables graduates to provide direct patient care without supervision.[12-15] In essence, these organizations attest to the educational quality of new and established educational programs. Only graduates from accredited educational programs are eligible for licensure in a jurisdiction that regulates the professions they externally validate.[12-15]

Chiropractic accrediting agencies typically set competencies or standards in areas such as neuromuscular expertise, health advocacy, technique and professionalism. However, a review of the accreditation standards for CEPs in Canada[12], Australasia[13], the United Kingdom[14] and the United States[15] revealed the complete absence of any specific mention of care of older patients (Table 1).

Only two accrediting agencies tangentially mention care of older persons. Metacompetency 3 (collaborator) from the Canadian Federation of Chiropractic Regulatory and Educational Accrediting Boards (CFCREAB) states chiropractors should be able to adopt to a "*variety of patient types and populations*".[12p6] The Council on Chiro-

Table 1.
Geriatric-Related Curricular Requirements from Canadian, American, Australasian and European Chiropractic Accreditation Agencies

Chiropractic Accreditation Agency	**Requirement with Respect to Care of Older Patient**
Canadian Federation of Chiropractic Regulatory and Educational Accrediting Boards, Entry-to-practice (2018)[12]	Metacompetency 3: Collaborator 3.1 Adapt to a variety of patient types and populations
Council on Chiropractic Education Australasia (2017)[13]	Practice Competency 4 (planning care) "…adopts practice according to varying patient needs across the human lifespan" Practice Competency 5 (implementing, monitoring and evaluating care: • Adopts interventions accounting for factors such as age, condition, health status…
European Council on Chiropractic Education, (2019)[14]	None
Council on Chiropractic Education Accreditation Standards, US (2018)[15]	None

practic Education Australasia's Practice Competency 4 (planning care) stated a chiropractor *"…adopts practice according to varying patient needs across the human lifespan"*[11p13] and Practice Competency 5 (implementing, monitoring and evaluating care) stated chiropractors adopt *"interventions accounting for factors such as age, condition, health status*" and other sociocultural characteristics.[13p14]

Coupled with our own experiences in chiropractic education we suspected this lack of guidance from accrediting agencies may have had the unintended consequence of each CEP developing its own geriatric course content. Indeed, this lack of GCE standardization was identified in a comparative audit published in 2009[16] discussed below. In turn, that audit cited previous attempts at GCE standardization a decade earlier.[17] However, to the best of our knowledge, no comparative audit of GCE has been conducted in the intervening years.

The objective of this study was to conduct a comparative audit of geriatric courses currently taught at English-speaking CEPs worldwide. The aim of this study was to describe the geriatric chiropractic curricula offered at these programs.

Methods

Since our study involved no human subject research it was granted ethics exemption by the IRB of Parker University (PUIRB- 2024-2).

Recruitment and sample

Leveraging our experience in the chiropractic educational ecosystem, we used purposeful sampling to contact faculty members or administrators at 34 accredited English-speaking CEPs (18 United States, six Australasian, five United Kingdom, two South Africa, one Canada, one Asian, one Central America) between May and December 2024. We asked to be referred to the person responsible for teaching geriatrics at their respective CEPs. Where no faculty member or administrators was known, we undertook an Internet search of accredited English-speaking CEPs hoping to identify the appropriate person teaching geriatrics. Once identified, individuals responsible for teaching geriatrics were contacted by email and invited to participate. If interested, they were sent 'Participation Information' and ethics exemption documentation and asked to read and sign the 'Consent to Participate' form. When potential respondents did not reply, we contacted them no more than three times. No compensation or incentives were offered to participate in our study.

Data collection and security

Upon consenting to participate, respondents submitted materials that included either a) their geriatric-related course, b) unit profile, or c) an outline of the geriatric-related content provided [Authors' note: some CEPs refer to their course outline as a unit profile]. Data was extracted and collated into pre-determined tables and anonymized by numerically coding each course outline in a non-alphabetical order in the order in which they were received. All data, along with participation information and consent forms, were stored on password protected computers, and the data was not shared externally from the research team.

Data analysis

Learning Objectives: Learning objectives (LOs), which were also often titled 'course objectives' or 'skills', were categorized together under LOs, and used to create a word cloud. The software tool used was WordCloud.com.[18] This is a web-based text visualization tools that generates word clouds based on the frequency of words given in a dataset. The platform supports direct text input or file upload and uses a built-in algorithm to analyze word frequency while allowing for customizable stop word removal. Users can adjust visual elements such as font, color, layout, and shape, though these features do not affect the underlying word frequency analysis.

The software does not perform qualitative coding or advanced linguistic analysis. The program serves as a visual tool to display term prominence. It is commonly used to complement qualitative research by providing an accessible summary of dominant language patterns. No local installation is required, and all processing occurred in the browser. In other words, a word cloud is a visual representation of terms (e.g. words, concepts, phrases) found in a data set: the relative size of each term is a reflection of the frequency of each term used in the data set which is, in turn, a reflection of each term's significance.

In our study, the goal of the word cloud was to accurately represent the core content of the LOs provided by participant CEPs visually, enabling emergence of key themes. This required removing the following non-content categories of word, high frequency filler words, gen-

eric educational phrases, Bloom's Taxonomy and course specific place holder terms. High frequency filler words included conjunctions (e.g. and, but), prepositions (e.g. in, with) and auxiliary verbs (e.g. is, will). Generic educational phrases such as "the student will be able to" and "demonstrate a knowledge of" are often used but do not reflect the course material under review. Bloom's Taxonomy words such as 'define' and 'analyze' were excluded since they also may not accurately reflect the course materials. Course specific place holder terms such as 'content', 'unit', 'assessment' and 'learning' were excluded. Lastly, the words were then revisited to correct misspellings and ensure uniformity in singular and plural terms as well as variations in spelling.

Course structure: The following pre-determined tables were used to categorize the course structure of the CEPs analyzed: delivery methods; direct contact time; assessment strategies; faculty credentials; required and recommended course material and; topical outlines. Following this, a table of topical outlines was created by reviewing materials and creating an alphabetized list for tabulation. This required higher categorization of course topics. For example, the topic category 'adverse drug reaction' also captured 'iatrogenic drug reactions' and 'polypharmacy'. Similarly, 'cognitive impairments' included 'cognitive decline', 'mental health illnesses' as well as 'dementia', 'delirium', 'depression' collectively referred to as the '3-Ds'.

Two members of our team met online to determine agreement on the categories and tables prior to data extraction and tabulation. One investigator (BJG) independently entered all data, and then a second investigator (KC) reviewed all course outlines against the table. A second online meeting was held to resolve discrepancies, with the primary investigator updating tables thereafter. This methodology mitigated any concerns with respect to investigator triangulation[19], increasing the study's dependability.[20]

Results

Of 34 CEPs invited to participate, 24 responded to the recruitment invitation. Of these, two CEPs declined to participate, and three CEPs agreed to participate but stated geriatric-related content was unable to be extracted from their curriculum (data was distributed among several

Table 2.
Course outlines analyzed from the following chiropractic educational programs (n=17).

Chiropractic Educational Program	**Country Located**
Australian Chiropractic College	Australia
Canadian Memorial Chiropractic College	Canada
Central Queensland University	Australia
Cleveland University	United States
D'Youville University	United States
Life University	United States
Life West University	United States
Logan University	United States
National University of Health Sciences – Florida	United States
Northeast College of Health Sciences	United States
Northeast College of Health Sciences	United States
Palmer College of Chiropractic– Davenport	United States
Parker University	United States
Teesside Chiropractic College	United Kingdom
Texas Chiropractic College	United States
University of Bridgeport	United States
Univeridad Central Del Caribe School of Chiropractic	Puerto Rico

courses or geriatric-related course content was currently under curricular review). As a result, those CEPs did not provide data for analysis.

In total, 19 CEPs provided geriatric-related materials. Upon review of the materials provided, we were unable to extract data for analysis from two CEPs, which were subsequently excluded from our study. Thus, data from 17 CEPs from the United States (*n=12*), Australia (*n=2*), United Kingdon (*n=1*), Canada (*n=1*), Puerto Rico (*n=1*) were analyzed.

Learning objectives

The LOs of 15 of the 17 participating CEPs were assessed. The output from the word cloud analysis can be found in Figure 2, where the most significant terms visualized were 'clinical', 'aging', 'management', 'conditions' and 'chiropractic'.

Course structure (Table 3)

Data extracted pertaining to the course structure of each CEP reviewed were tabled under the following sub-headings: course organization; total of contact hours; delivery methods; and; assessment strategies.

Course organization (Table 3)

In total, 15 of the 17 CEPs had a standalone geriatric course. Two other CEPs taught geriatrics within courses that also taught female care/obstetrics and pediatrics.

Figure 2.
Word Cloud of learning objectives of the 17 chiropractic educational programs audited in this study.

Table 3.
Course structure of each chiropractic educational program.

CEP	Standalone Geriatric Course	Total of Contact Hours*	Delivery Methods	Assessment Strategies
1	√	26	L	Q; W
2	√	N/A +	L	W
3	√	20	L	Q; W
4	√	20	L	A; W
5	√	30*	L	A; W
6	√	37	L; P	A; P; Q; W
7	√	26	L	A; W
8	√	28	L	Q; W
9		11	L	A
10	√	17	L; TBL	A; Q; W
11	√	14	L	A; CP; Q; W
12	√	24	L	P; Q; R; W
13	√	24	L	P; Q; W
14		16	L	W
15	√	15	L	A; CP; Q; W
16	√	20	L	F; W
17	√	15	L	A
* Does not include self-directed learning				
+ Delivered online asynchronously with no set time limit				
Abbreviations: A= Assignment; CEP = Chiropractic Educational Program; CP = Class Participation; F = Feedback; L = Lecture; P = Practical Lab; P = Project; Q = Quizzes; R = Referral List; TBL = Team Based Learning; and W= Written Examination				

Delivery methods (Table 3)

All CEPs delivered geriatric course content by lectures. One CEP also included a practical lab and one CEP included a three-hour Team Based Learning (TBL) session.

Direct contact time (Table 3)

Excluding contact hours designated as 'self-directed learning', the number of direct course contact hours for 16 CEPs varied between 11 and 26 (average to 21.4 hours) with one CEP delivering geriatric content online with no designated length of time for each lecture.

Assessment strategies (Table 3)

Among the 17 CEPs, seven different assessment strategies were identified. Fifteen CEPs used written examinations, and nine CEPs (although not the same nine CEPs) also used assignments or quizzes to assess students. Three CEPs used practical assessments, two CEPs used class participation, and two other different CEPs used either 'feedback' (no further information provided) or creation of a 'referral' list (no further information provided). Four CEPs used four different assessment strategies (two of these four CEPs used the same assessment strategies). One CEPs used three different assessment strategies. Seven CEPs used two assessment strategies, with two CEPs using the same two assessment strategies and another two CEPs using the same two (albeit two different) assessment strategies. Four CEPs only used one type of assessment strategy.

Faculty credentials and required and recommended course material (Table 4)

Table 4 presents the credentials of teaching faculty as well as required course and recommended course material used by the chiropractic educational programs reviewed.

Faculty credentials (Table 4)

Teaching faculty who delivered geriatric content at all CEPs were chiropractors, although at 13 CEPs the teaching faculty who delivered geriatric content held other advanced academic credentials.

Required or recommended course material (Table 4)

Eleven CEPs listed required course materials, and eight CEPs listed recommended course materials (e.g. textbooks, journal articles); however, there was very little consistency between CEPs. The most commonly required or recommended course material was the textbook on differential diagnosis by Souza *et al*[21] *(n=5)* followed by the Merck Manual[22] *(n=4)* and the textbooks by either Bougie and Morgenthal[23] *(n=3)* or Gleberzon *(n=3)*.[24] Different CEPs used different versions of either the Merck Manual or textbook by Souza. For the sake of brevity, we have provided one reference for each reference as an example of one of the versions used.

Topical outlines (Tables 5a-5h)

In total, 40 different topics across the 17 course outlines we audited were identified (Tables 5a-5h). No CEP taught all 40 topics; the highest number of topics covered at one CEP was 28 and only one other CEP taught at least half (*n=20*) of all identified topics. The average number of topics taught was 12.8. The most commonly taught geriatric-related topics were neurological disorders (*n=15*), chiropractic care, cognitive impairments, geriatric assessment and falls (each *n=12*), followed by musculoskeletal (MSK) disorders and normal ageing (each *n=11*). Four topics (housing/hospice care, the "I's", sleep disorders and visceral disorders) were taught at only one CEP.

Table 4.
Faculty credentials and required/recommended course material

CEP	Faculty Credentials	Required Course Material	Recommended Course Materials
1	DC; MA	Souza T. Differential diagnosis and management for the chiropractor	None listed
2	DC; DACBR	None listed	Physiological Basis of Aging and Geriatrics by Timiras
3	DC; BA	Essentials of Clinical Geriatrics, 8ed. Kane, Ouslander and Abrass	Merck Manual of Health and Aging, ISBN: 0-911910-36-0 Life University radiology handbook, 3755 Course Documents, BlackBoard
4	DC	Bickley LS. Bate's Guide to Physical Examination and History. Philadelphia, PA: Lippincott, Williams & Wilkins; Latest edition	Merck Research Staff. Merck manual professional version: geriatrics [Internet]. Rahway, NJ: Merck & Co. Inc. c2024. Bougie, J.D, Morgenthal, A.P. The aging body. NY: McGraw-Hill; 2001 Fulmer T, Peloton L. Age-friendly health systems: a guide to using the 4Ms while caring for older adults. Boston, MA: Institute for Healthcare Improvement. 2022 Gleberzon B.J. Chiropractic care of the older patient. Boston, MA: Butterworth-Heinemann; 2001 Kane, R.L. et al. Essentials of clinical geriatrics. 6th ed. NY: McGraw-Hill; 2009 Landefeld, C.S. et al., editors. Current geriatric diagnosis and treatment. NY: Lange Medical Books/McGraw-Hill; 2004

CEP	Faculty Credentials	Required Course Material	Recommended Course Materials
5	DC; BS	Differential Diagnosis and Management for the Chiropractor 5th edition. Souza. Jones & Bartlett Learning, 2016.	Adult – Gerontology Nurse Practitioner Certification Review Guide. 6th Edition. Miller. Jones & Bartlett Learning 2014 The Merck Manual of Geriatrics: 3rd edition. Merck Publishing Co., 2000 Chiropractic Care of the Older Patient: Gleberzon. Butterworth-Heinemann. 1998 Reichel's Care of the Elderly: Clinical aspects of Aging. 5th ed. Gallo, Lippincott, 1999 The Little Black Book of Geriatrics: 3RD ed. Onion. Jones and Bartlett. 2006 Geriatric Compass Notes: by James Van Wagoner. Published by National Board Specialists. Office Care Geriatrics: Rosenthal, Naughton, Williams: Lippincott, Williams & Wilkins. 2006. Fundamentals of Geriatric Medicine: edited by Cape, Coe, Rossman. Raven Press, 1983 Current Geriatric Diagnosis & Treatment:2014 Papadakis, McPhee, Rabow: Lange Medical Books. 2014 Primary Care Geriatrics: A Case-Based Approach. 2nd ed. Ham, Sloane. Mosby Year Book. 1992 Geriatric Physical Diagnosis: A Guide to Observation and Assessment: Williams, McFarland and Company, 2009
6	DC; MS; DACBSP	Rose DJ. Fall Proof! Human Kinetics, 2nd Edition 2010	None listed
7	DC; BA; MHSc	Dougherty P, Hawk C, Weiner CK, Gleberzon BJ et al. The role of chiropractic care in older patients. Chiro and Manal Ther 2012;20(1)	Several articles
8	DC	Chiropractic Care of the Older Patient: Gleberzon. Butterworth-Heinemann. 2001 Souza T. Differential diagnosis and management for the chiropractor	Other assignment readings
9	DC; MS DABCI	Seidel's Guide to Physical Examination by Jane W Ball, Jane W. Ball, John A. Flynn, et al.	
10	DC; BSc; MSc	None listed	None listed
11	DC; MPH; MS	Class notes	Bougie JD, Morganthal. *The Aging Body: Conservative Management of Common Neuromusculoskeletal Conditions,* AP, Mc-Graw Hill, New York, 2001 ISBN-13:9780838503317 Hooper PD, *A Baby Boomer's Guide to Aging and Ergonomics*, The WorkAbility Management Group, Diamond Bar, CA, 2007 Hooper PD, *Age-Proof Your House*, The WorkAbility Management Group, Diamond Bar, CA, 2008 Johnson C, Green BN, Davis JM, Cleveland CS. *Review Questions for the NBCE Examination*, Elsevier, St. Louis, 2006

CEP	Faculty Credentials	Required Course Material	Recommended Course Materials
12	DC; MS; DHED	None listed	None listed
13	DC PhD	None listed	None listed
14	DC	None listed	Bates' Guide to Physical Examination and History Taking 13th ed. Lippincott Williams & Wilkins, 2020. Differential Diagnosis and Management for the Chiropractor 5th ed Souza. Jones & Bartlett, 2016. Merck Manual of Diagnosis and Therapy, 19th ed. Merck & Co, 2011.
15	DC	Ham's Primary Care Geriatrics Subtitle: A Case-Based Approach 7th ed. ISBN: 978-0-323-721684 Authors: Warshaw G, Potter J, Flaherty E, Heflin M, McNabney M, Ham R Publisher: Elsevier Publication Date: 2021 Edition: 7th	None listed
16	DC, PhD	Souza, Thomas. Differential Diagnosis and Management for the Chiropractor, Protocols and Algorithms. Jones & Bartlett Learning LCC; 2016	Wyatt, Lawrence. Handbook of Clinical Chiropractic Care. Jones and Barlett Publishers; 2005. Biedermann, Heiner. Manual Therapy in Children. Churchill Livingstone; 2004.
17	DC; MPH; FHEA; FRSPH, FRCC	None listed	None listed

Abbreviations: BA (Bachelor of Arts); BS (Bachelor of Science); DACBSP (Diplomate of the American Chiropractic Board of Sports Physicians); DABCI (Diplomate of the American Board of Chiropractic); DACBR (Diplomate, American Chiropractic Board of Radiology);DC (Doctor of Chiropractic); DHED; Doctor of Health Education; FHEA (Fellowship of the Health Education Academy); FRCC (Fellow of the Royal College of Chiropractors); FRSPH (Fellow of the Royal Society for Public Health); MHSc (Master of Health Sciences); MPH (Master of Public Health; MS (Master of Science); PhD (Doctor of Philosophy)

Table 5a.
Geriatric course topics: adverse drug reactions to cardiovascular disease

CEP	Adverse Drug Reactions Ω	Ageism	Cancer	Cardiopulmonary Disease	Cardiovascular
1		√			
2	√			√	√
3					√
4		√			
5	√				√
6				√	√
7	√	√	√	√	
8				√	√
9					
10		√			
11					

CEP	Adverse Drug Reactions Ω	Ageism	Cancer	Cardiopulmonary Disease	Cardiovascular
12	√				
13					
14	√				
15			√		√
16			√		√
17					√
Ω Adverse drug reactions; iatrogenic drug reactions; polypharmacy; pharmaceutical concerns					

Table 5b.
Geriatric course topics: chiropractic care to diabetes

CEP	Chiropractic Care*	Cognitive Impairments+	Demographics	Dermatological Disorders	Diabetes
1	√	√			
2	√		√	√	√
3		√	√		
4	√				
5	√	√	√		
6		√			
7	√	√	√		√
8	√	√	√	√	
9		√		√	√
10	√	√	√		
11		√			
12		√			
13	√	√	√		
14	√				
15	√				
16	√				
17	√	√			
*Chiropractic Care includes: manual therapy; modifications to spinal manipulative therapy; Good Life with osteoArthritis Denmark (GLA-D); Lumbar Spinal Stenosis Boot camp; Chiropractic maintenance care					
+Includes Dementia. Delirium and Depression. Alternatively labelled as ‘mental health’ or ‘cognitive decline’					

Table 5c.
Geriatric course topics: elder abuse to funding sources.

CEP	Elder Abuse	Endocrine Disorders	Ethics/ Jurisprudence	Exercise/ Rehabilitation	Falls	Funding Sources
1	√		√		√	
2		√		√		
3	√		√		√	
4	√				√	√
5					√	√
6	√			√	√	√
7				√	√	
8				√		
9	√	√			√	
10			√	√	√	
11				√	√	
12					√	
13				√	√	
14						
15					√	
16				√		
17				√		

Table 5d.
Geriatric course topics: gastrointestinal disorders to hospice (end of life)

CEP	Gastrointestinal Disorders	Geriatric Assessment	Health Promotion/ Disease Prevention#	Housing/Home Care	Hospice (EOL)^
1		√	√	√	
2	√		√		
3					
4		√			
5		√			
6		√			
7		√	√		√
8	√	√			
9		√			√
10		√			
11		√			
12		√			

CEP	Gastrointestinal Disorders	Geriatric Assessment	Health Promotion/ Disease Prevention#	Housing/Home Care	Hospice (EOL)^
13		√	√		
14					
15					
16					
17		√			
# Alternatively labelled as: lifestyle factors; wellness					
^ EOL = End of Life					

Table 5e.
Geriatric course topics: "I's" to Nutrition.

CEP	'I's'§	Immobility	Instability>	'M's'<	MSKΦ	Neurological Disorders**	Nutrition
1					√	√	
2					√	√	√
3		√	√				
4				√			
5					√	√	
6			√		√	√	
7	√	√	√			√	
8			√		√	√	
9			√			√	
10		√	√		√	√	
11			√		√	√	√
12				√		√	
13			√		√	√	
14					√	√	√
15						√	√
16			√		√	√	√
17					√	√	
§ = Iatrogenic drug reactions; instability; immobility; intellectual impairment incontinence; isolation							
>Gait; Dizziness							
<Medication; mental health; mobility; what matters most							
Φ Includes scoliosis; 'orthopedic impairment'							
** Includes Parkinson's; multiple sclerosis; myelopathy							

Table 5f.
Geriatric course topics: Normal ageing to sex and sexuality.

CEP	Normal Ageing	Osteoarthritis λ	Osteoporosis	Sex and Sexuality
1				
2	√			
3	√			
4	√			
5	√			
6	√	√	√	
7	√	√	√	√
8	√	√	√	
9		√		
10	√	√	√	√
11				
12	√		√	
13		√	√	
14	√			
15				
16	√		√	
17				
λ Includes spinal stenosis				

Table 5g.
Geriatric course topics: sleep disorders to terminology.

CEP	Sleep Disorders	Special Needs++	Sociocultural issues^^	Terminology
1			√	
2				√
3				
4				√
5		√		
6				
7	√	√	√	√
8				

CEP	Sleep Disorders	Special Needs++	Sociocultural issues^^	Terminology
9		√		
10			√	√
11			√	
12			√	
13		√	√	
14				
15				
16				
17			√	
++ Persons with disabilities (in wheelchairs). One CEP listed 'social care' which we included here				
^^ Includes: social theories of ageing; economic challenges; diversity, inclusion and equity				

Table 5h.
Geriatric course topics: Theories of ageing to visceral.

CEP	Theories of Ageing	Types of Ageing	Urinary Incontinence	Visceral
1				√
2	√		√	
3			√	
4				
5	√			
6	√	√		
7	√	√	√	
8			√	
9				
10	√		√	
11	√			
12				
13				
14				
15				
16				
17				

Discussion

We found nearly all CEPs had a standalone geriatric course, and that all CEPs delivered geriatric course content by lectures. All lecturers were chiropractors, and two-thirds of these faculty members had other professional degrees. Almost all geriatric content was assessed with written examinations.

There was a high degree of variability of course topics identified, with 40 different topics across the 17 CEPs. There was also a great deal of inconsistency with respect to hours allocated for geriatric education and to both required and recommended course materials. Although certain generic geriatric-related words were highlighted in the word cloud presented above overall learning objectives and outcomes across institutions varied significantly, suggesting a lack of alignment and perhaps differing curricular priorities.

Some of the inconsistency in geriatric-related curriculum most likely originated from the late 1990s, where Hawk, Killinger and colleagues provided recommendations toward a 'model curriculum'. The purpose was to increase the breadth and depth of GCE based on a number of sources, including course syllabi provided by nine of 18 American chiropractic programs.[17] Later, in 2001 Hawk, Byrd and Killinger[25] sought to measure changes in students' attitudes toward care of older patients and interprofessional collaboration after participating in a course based on that model curriculum. Twenty students volunteered to enroll in the model curriculum course, compared to 197 students who attended the regular geriatric course offered by Palmer College-Davenport. Compared to their classmates, students enrolled in the model curriculum course demonstrated more positive attitudes toward older persons. Students in the model curricular course uniformly reported it was a positive experience especially with respect to experiential activities, lecturers provided by a variety of speakers from different professions (e.g. nurses, anthropologists), small group discussions and small class size.[25]

A decade later Borggren, Osterbauer and Wiles[16] conducted a 10 year follow up study of geriatrics course syllabi of 18 English-speaking chiropractic programs across North America. Borggen *et al*.[16] reported all courses were delivered by lectures (including guest lecturers), although a few also included practical demonstrations (*n=2*) and small group discussions (*n=2*). Of the 18 courses surveyed, 15 were taught by chiropractors (three were of unknown credentials based on the syllabus). There was a great deal of variability between assessment strategies, ranging from various activities, projects and presentations to quizzes and final written examinations. Lastly, geriatric courses tended to be taught later in the undergraduate program (for example, 5th to 8th trimester or 9th quarter).[16]

In comparison to Borggren *et al*.'s study where the number of hours of instruction varied between 8 and 48 hours (average 25.9 hours)[16], we found the number of direct course contact hours varied between 11 and 26 (average to 21.4 hours). What was new and novel, however, was one participant CEP in our study stated they delivered geriatric content exclusively online.

In our study, the five most commonly taught topics were neurological disorders, chiropractic care, cognitive disorders, geriatric assessment and falls. Borggren *et al*.[16] reported the five most commonly taught 'essential topics' (as they labelled them) were: pathophysiology of aging (*n=14*); normal aging, physiology and wellness (*n=13*); psychological and mental considerations (*n=9*); concurrent care planning (*n=9*) and; communication skills for providers (*n=8*). Their survey reported no respondent program taught elder abuse, where in our study, six CEPs taught it. Although Borggren *et al*. recommending more time be dedicated to GCE in general and more clinical experiences be included in course planning no specific recommendations were offered with respect to topics or core competencies.[16]

Studies on geriatric education for other healthcare providers

Specific core competencies, topics and enhanced skills that ought to be taught in family medical curricula was published in 2014. These recommended core competencies could serve as a template for the education of other healthcare providers involved in care of older patients, including chiropractic students (see Table 6).[26]

Although there have not been any updates to these recommended core competencies to date there have been other suggestions to enhance the education of healthcare providers working with older patients. In 2017, Tinetti and her colleagues[27] introduced the 5 Ms – mobility, medications, mind, multicomplexity and what matters most – as a simplified and focused framework to enhance education and training in geriatrics for medical students. This 5Ms

Table 6.
Recommended core competencies for family medicine geriatric curriculum[26]

A. Cognitive Assessment
B. Functional Assessment (Self-Care Capacity)
C. Falls, Balance, and Gait Assessment
D. Medical Management
E. Biology of Aging and Atypical Presentation of Disease
F. Adverse Events and Safety
G. Incontinence
H. Transition of Care
I. Healthcare Planning
J. Professionalism
K. Communication
L. Research

framework was used to update and organize the Minimum Competencies in Geriatric for Medical Students in 2021.[28] Soon thereafter Goldberg *et al*.[29] used a 4Ms framework (mind/memory, medications, mobility and what matters most) for an interactive, skills-based session for second year medical students. Lastly, Glassburn *et al*.[30] successfully used a short-term curricular model for advanced learners in geriatric team care settings that focused on five areas of concern: medical management, dementia, depression, falls and myths about ageing. Our audit revealed two CEPs structure their geriatric chiropractic curriculum around the '4M' model (see Table 5e).

Possible implications to clinicians

The lack of consistency revealed in our comparative audit with respect to delivery methods, assessment strategies and required and recommended course material probably have very little impact on the knowledge base or skill level required of clinicians to competently treat their geriatric patients; however, it is certainly possible that the lack of consistency of topics covered between CEPs could impact a clinician's knowledge or skill level.

We propose a model chiropractic educational program regarding older patients worldwide to improve the knowledge base of chiropractic students and, by extension, chiropractors, enhancing patient care for not only the largest growing segment of the population, but 16% of chiropractic patients.[8] Another collateral benefit of improved GCE could enhance opportunities for chiropractors to work collaboratively with other stakeholders, such as medical doctors, geriatricians, nurse practitioners and social workers in the geriatric care milieu, including hospitals, outpatient clinics and long-term care facilities. Ultimately, this may fortify the profession's cultural authority as spinal pain experts, particularly for older persons.

Strengths, weaknesses and limitations of this study

A strength of our study was it included data from 17 CEPs worldwide (Figure 3). This enabled us to conduct a robust and comprehensive comparatively audit of English-speaking accredited CEPs. However, a weakness of this study was we only included English-speaking CEPs; it is possible the inclusion of non-English speaking CEPs would alter our results with respect to topics delivered, percentage of topics taught, characteristics of teaching faculty, delivery methods, types of assessment strategies used, required and recommended course material and the appearance of the word cloud.

Our study was limited due to course outlines submitted for our review represented a 'snapshot' in time. Indeed, several participating CEPs informed us their curricula in general - and the geriatric course in particular - were undergoing review. Another limitation in our study is we could not know if other geriatric-related content was taught in other courses in a particular CEP on an *ad hoc* basis. For example, recommendations to modify high velocity low amplitude-spinal manipulative therapy (HVLA-SMT) for older, frail patients may be taught in technique classes and recommendations for certain exercise targeting older patients may be taught in rehabilitation courses.

The description of topics covered in some of the course outlines were vague. It is therefore possible we misinterpreted them. It is also possible we erred during our strategy to amalgamate a variety of topics into a single topic as we did for 'adverse drug reactions' and 'cognitive impairments'.

It is quite possible course outlines submitted did not include all topics covered. For example, we know of certain geriatric courses analyzed in this study that teach breaking bad news, chiropractic management of non-NSMK conditions (e.g. gastrointestinal reflux disorder) and fibromyalgia but these were not listed in the course out-

line submitted. Similarly, we believe it is unlikely that all CEPs did not devote class time to the topics of geriatric assessment, falls and modification to chiropractic treatment, and yet not our data does not reflect that. To address this limitation we could have contacted each course coordinator and ask them to clarify if topics other than those in the course outline were discussed in class; however, we resisted the temptation to do so since we feared they might feel pressured to state they did in fact discuss this or that topic if even tangentially, lest they give the appearance their course is not comprehensive.

Lastly, it is possible our study suffered from a lack of either method or investigator triangulation[19] but we believe this was sufficiently mitigated by having three authors interpret the data and contribute to the drafting of this manuscript.

Implications for future research

The data generated from this comparative audit may help individual course coordinators improve their respective geriatric courses by adopting topics, delivery methods or assessment strategies they may not have otherwise considered adopting. This data could also be used to: (i) enhance the metacompetencies required by accrediting agencies for chiropractic geriatric courses; (ii) ensure chiropractic geriatric curricula align with core competencies recommended for family medicine curricula and (iii) lead to the development of a model chiropractic geriatric curricula for chiropractic educational programs worldwide.

In order to develop a model chiropractic geriatric curricula, we envision adopting the same methodology Hawk *et al*.[31] used during the development of clinical practice guidelines for the role of chiropractic care in providing health promotion and clinical preventive services for adult patients with MSK pain. It is recommended a multidisciplinary steering committee combine the results of this study with a systematic review of the geriatric literature and draft a set of recommendations for standardized geriatric chiropractic education. A Delphi panel comprised of experienced practitioners and teaching faculty who specialize in geriatrics as well as other subject matter experts would then be tasked with rating these recommendations using a consensus-based methodology such as the one established by the RAND corporation/University of California and develop core competencies and essential curricular topics. These findings could then be compared to existing syllabi to identify any gaps or redundancies. A draft consensus statement would then be generated and distributed to the Delphi panel for final approval prior to publication.[31]

Conclusion

We analyzed course outlines submitted by 17 English-speaking CEPs. There was consistency with respect to teaching faculty, methods of course delivery and assessment strategies; however, we found a great deal of variability between learning objectives and a lack of consistency in required or recommended course resources. More importantly, we found a high amount of variability with respect to topics presented at each CEP reviewed. More research, including the standardization of geriatric curriculum, in this vitally important aspect of chiropractic education is warranted.

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