

COMMENTARY

Open Access



# A united statement of the global chiropractic research community against the pseudoscientific claim that chiropractic care boosts immunity

Pierre Côté<sup>1,2,3\*</sup>, André Bussi eres<sup>4,5</sup>, J. David Cassidy<sup>3</sup>, Jan Hartvigsen<sup>6,7</sup>, Greg N. Kawchuk<sup>8</sup>, Charlotte Leboeuf-Yde<sup>9</sup>, Silvano Mior<sup>2,10</sup>, Michael Schneider<sup>11,12</sup> and and more than 140 signatories# call for an end to pseudoscientific claims on the effect of chiropractic care on immune function

## Abstract

**Background:** In the midst of the coronavirus pandemic, the International Chiropractors Association (ICA) posted reports claiming that chiropractic care can impact the immune system. These claims clash with recommendations from the World Health Organization and World Federation of Chiropractic. We discuss the scientific validity of the claims made in these ICA reports.

**Main body:** We reviewed the two reports posted by the ICA on their website on March 20 and March 28, 2020. We explored the method used to develop the claim that chiropractic adjustments impact the immune system and discuss the scientific merit of that claim. We provide a response to the ICA reports and explain why this claim lacks scientific credibility and is dangerous to the public. More than 150 researchers from 11 countries reviewed and endorsed our response.

**Conclusion:** In their reports, the ICA provided no valid clinical scientific evidence that chiropractic care can impact the immune system. We call on regulatory authorities and professional leaders to take robust political and regulatory action against those claiming that chiropractic adjustments have a clinical impact on the immune system.

**Keywords:** Chiropractic, Spinal manipulation, Immunity, Pseudoscience, Coronavirus

## Background

We are currently facing the greatest global public health crisis in a century. Fighting the coronavirus pandemic has required that we change the way we live and observe strict public health guidelines. This is necessary because, at this time, there are no effective vaccines, treatments

or cures for COVID-19 [1, 2]. Chiropractors, as members of the health care system, should disseminate the best available public health information to the public [3]. Any attempt to behave otherwise can be misleading and potentially dangerous to individual patients and the public at large.

On March 20, 2020, the International Chiropractors Association (ICA), a US based chiropractic organization, posted a report claiming that chiropractic adjustments can boost immune function with the implication that it might be helpful in preventing COVID-19 [4]. In their

\* Correspondence: [pierre.cote@uoit.ca](mailto:pierre.cote@uoit.ca)

<sup>1</sup>Faculty of Health Sciences, Ontario Tech University, Oshawa, Canada

<sup>2</sup>Centre for Disability Prevention and Rehabilitation at Ontario Tech University and CMCC, Oshawa, Canada

Full list of author information is available at the end of the article



  The Author(s). 2020 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

report, the ICA states that: “*Although there are no clinical trials to substantiate a direct causal relationship between the chiropractic adjustment and increased protection from the COVID-19 virus, there is a growing body of evidence that there is a relationship between the nervous system and the immune system*” and “*The observation that those who use chiropractic regularly and do not become ill with cold, flu, or other community shared illnesses is frequent within the profession and should not be ignored*” [4]. The ICA position directly contradicts the World Health Organization (WHO) that unequivocally states that “*there are no effective health interventions to prevent or treat coronavirus infections*” [1, 2], and the World Federation of Chiropractic (WFC) that states that “*there is no credible scientific evidence that chiropractic spinal adjustments/manipulations confers or boosts immunity*” [3].

On March 28, 2020, the ICA posted a revised report which reiterated the information included in the first report, with the addition of references supporting the link between chiropractic care and immune function [5]. In both reports, the ICA claims that their review of the literature confirms “*An association between spinal manipulation and the autonomic nervous system*” and that “*These studies suggest mechanisms by which spinal influences may mediate a clinically significant impact on immune function.*” Therefore, the main message of both reports is that chiropractic care can have a clinically meaningful impact on immune system function. We discuss the scientific validity of the claims made by the ICA.

### Main body

We investigated the approach used by the ICA to support their claim that chiropractic adjustments impact the immune system. We compared the ICA claim to the findings and conclusions of one systematic review of the literature on the effect of spinal manual therapies on autonomic nervous system activity [6] and two systematic reviews on the efficacy and effectiveness of chiropractic treatment and manual therapy on the prevention and treatment of non-musculoskeletal disorders [7, 8]. Further, we used a list of warning signs of pseudoscience to assess the scientific merit of the claims [9]. Finally, 153 researchers from 11 countries (8 co-authors and 145 signatories) who are involved in research relevant to chiropractic reviewed and endorsed our response.

While the ICA states “*that no claims can be made about COVID-19 and chiropractic*”, their report implies that chiropractic adjustments can boost the immune system through its effect on the nervous system. The ICA claim rests on two assumptions: i) chiropractic adjustments have a beneficial effect on the nervous system and ii) chiropractic adjustments will improve the immune

system through the nervous system. These assumptions are not supported by robust evidence that chiropractic adjustments are efficacious or effective in improving immune function [6–8]. We consider that proclaiming the benefits of chiropractic adjustment/spinal manipulation on immunity during a pandemic is plainly irresponsible and demonstrates a lack of understanding of science, the coronavirus pandemic and public health risks.

Our critical review of the reports suggest that the ICA created a positive narrative for the effect of chiropractic adjustments and immune function report by selectively assembling a series of unconnected basic science studies [4, 5]. This strategy, called “emphasis on confirmation”, is a warning sign of pseudoscience [9]. Moreover, this approach fails to respect the established boundaries that exist between basic and clinical research. For example, two of the basic science studies included in the ICA report were led by one of the signatories of this commentary, Stephen Injeyan DC, PhD [10, 11]. According to Dr. Injeyan: “*No published studies have so far demonstrated the clinical significance of spinal manipulation and immune enhancement, our research included. Our studies were conducted in asymptomatic subjects, in vitro cellular models, and the outcomes were measured shortly following SMT. There are no parallels between our experimental research and clinical care.*” By only citing basic science experiments, the ICA appear to have overlooked the WHO guidance on implementation research, which clearly states that basic science experiments do not provide relevant justification for implementation of a health intervention [12].

Any health care intervention must be evaluated for its clinical efficacy and effectiveness in well-designed randomized controlled trials before it is implemented in clinical practice [12]. This requirement is not new; it was first implemented by the US Food and Drug Administration in 1962 [13]. With this in mind, it is all the more noteworthy that none of the studies cited in the ICA report provide evidence that chiropractic adjustments actually prevent the onset of infectious diseases in healthy individuals, or improve the health of patients suffering from a viral infection. We call on the ICA to explain why it does not adhere to internationally accepted standards of research implementation but instead rely on unconnected basic science studies when linking chiropractic care to immune system function.

The ICA also relied on anecdotal evidence to support their claim; this is another warning sign of pseudoscience [9]. For example, the authors state: “*The observation that those who use chiropractic regularly and do not become ill with colds, flu, and other community shared illnesses is frequent within the profession and should not be ignored*” [4, 5]. At best, this type of anecdotal

evidence is useful to generate research hypotheses to be tested in high quality randomized clinical trials. To our knowledge, the hypothesis that chiropractic care reduces the risk of becoming ill with viral colds, flu, and other community shared illnesses has never been properly tested. Any claims suggesting otherwise lack scientific merit and should not be used to justify treating patients with chiropractic adjustments.

Advancing extraordinary claims without providing extraordinary evidence should raise significant concerns about the scientific validity of the ICA's position. In their reports, the ICA claims that individuals who received chiropractic care during the 1918 Spanish flu pandemic were 51 to 91 times less likely to die than those who were treated by medical doctors [4, 5]. These effect sizes are too large to be trustworthy and are a red flag of pseudoscience, because extraordinary claims require extraordinary evidence [9]. Using data from a 100-year-old non-published, non-randomized controlled trial to suggest that chiropractic adjustments reduces mortality from the flu is scientifically and socially irresponsible.

Pseudoscience has the potential to mislead and misinform at any time; even more so in the midst of a pandemic when the public is vulnerable. The current coronavirus pandemic demands that we act responsibly by adopting sound public health practices as recommended by the WHO [14]. These include but are not restricted to regular handwashing, respiratory etiquette, physical distancing, staying at home, limiting trips outside the home except to obtain food or medicine and wearing a mask if symptomatic [14]. We have seen widespread adherence to the guidance around COVID-19, but as scientists and clinicians we have a public health duty to sound the alarm and denounce pseudoscientific claims such as the ones made by the ICA in its reports.

## Conclusion

We call on regulatory authorities and professional leaders to take appropriate political and regulatory action against those making direct or indirect unsubstantiated claims that spinal adjustments can boost immunity, or benefit patients with infectious diseases, especially coronavirus infections. Above all, these actions must aim to protect the safety and well-being of patients and the public.

## Abbreviations

FDA: Food and Drug Administration; ICA: International Chiropractors Association; WHO: World Health Organization; WFC: World Federation of Chiropractic

## Acknowledgements

Not applicable.

## #SIGNATORIES

The views and opinions expressed herein are those solely of the authors and may not represent the views of their institution.

1. Luc Aillet, Private practice, Ghent, Belgium
2. Carlo Ammendolia, University of Toronto, Toronto, Canada
3. Bodil Arnbak, University of Southern Denmark, Odense, Denmark
4. Iben Axen, Karolinska Institute, Stockholm, Sweden
5. Mirjam Baechler, University of Zurich, Zurich, Switzerland
6. Florian Barbier-Cazorla, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France
7. Gaëtan Barbier, Institut Franco-Européen de Chiropraxie, Toulouse, France
8. Cecilia Bergström, Umeå University, Umeå, Sweden
9. Amber Beynon, Murdoch University, Perth, Australia
10. Marc-André Blanchette, Université du Québec à Trois-Rivières, Trois-Rivières, Canada
11. Philip S Bolton, University of Newcastle, Callaghan, Australia
12. Alan Breen, AECC University College, Bournemouth, UK
13. Johanne Brinch, University of Southern Denmark and Spine Center of Southern Denmark, Odense, Denmark
14. Gert Bronfort, University of Minnesota, Minneapolis, USA
15. Benjamin Brown, Macquarie University, Sydney, Australia
16. Paul Bruno, University of Regina, Regina, Canada
17. Mikkel Brunggaard Konner, University of Southern Denmark and Spine Center of Southern Denmark, Odense, Denmark
18. Christopher Burrell, Macquarie University, Sydney, Australia
19. Jason W. Busse, McMaster University, Hamilton, Canada
20. David Byfield, Welsh Institute of Chiropractic University of South Wales Pontypridd, Wales UK
21. Marco Campello, NYU Robert I Grossman School of Medicine, New York, USA.
22. Carol Cancelliere, Ontario Tech University, Oshawa, Canada
23. Linda Carroll, University of Alberta, Edmonton, Canada
24. Christine Cedraschi, University of Geneva, Geneva, Switzerland
25. Charlene Chéron, French Chiropractic Association, Paris, France
26. Ngai Chow, Canadian Memorial Chiropractic College, Toronto, Canada
27. Henrik Wulff Christensen, Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark
28. Stine Clausen, University of Southern Denmark, Odense, Denmark
29. Melissa Corso, Ontario Tech University, Oshawa, Canada
30. Matthew A. Davis, University of Michigan Medical School, Ann Arbor, USA
31. Marine Demortier, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France
32. Martin Descarreaux, Université du Québec à Trois-Rivières, Trois-Rivières, Canada
33. Diana De Carvalho, Memorial University of Newfoundland, St. John's, Canada
34. Katie de Luca, Macquarie University, Sydney, Australia
35. Annemarie de Zoete, Vrije University, Amsterdam, The Netherlands
36. Klaus Doktor, University of Southern Denmark, Odense, Denmark
37. Aron Downie, Macquarie University, Sydney, Australia
38. Alister du Rose, AECC University College, Bournemouth, UK
39. Andreas Eklund, Karolinska Institute, Stockholm, Sweden
40. Roger Engel, Macquarie University, Sydney, Australia
41. Mark Erwin, University of Toronto, Toronto, Canada
42. James E. Eubanks, University of Pittsburgh, Pittsburgh, USA
43. Roni Evans, University of Minnesota, Minneapolis, USA
44. Will Evans, Mississippi State University, Mississippi State, USA
45. Matthew Fernandez, Macquarie University, Sydney, Australia
46. Jonathan Field, University of Southampton, Southampton, UK
47. Gilles Fournier, Parker Institute, Copenhagen University Hospital at Bispebjerg and Frederiksberg, Denmark
48. Simon French, Macquarie University, Sydney, Australia
49. Signe Fuglkjaer, Private practice, Odense, Denmark
50. Olivier Gagey, University of Paris-Saclay, Orsay, France
51. Rosemary Giuriato, Macquarie University, Sydney, Australia
52. Jordan A. Gliedt, Medical College of Wisconsin, Milwaukee, USA
53. Christine Goertz, Duke University School of Medicine, Durham, USA
54. Guillaume Goncalves, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France
55. Diane Grondin, Canadian Memorial Chiropractic College, Toronto, Canada
56. Mark Gurden, Royal College of Chiropractors, Reading, UK
57. Mitchell Haas, University of Minnesota, Minneapolis, USA
58. Scott Haldeman, World Spine Care, Los Angeles, USA

59. Steen Harsted, University of Southern Denmark, Odense, Denmark  
 60. Lisbeth Hartvigsen, Private Practice, Odense, Denmark  
 61. Jill Hayden, Dalhousie University, Halifax, Canada  
 62. Cesar Hincapié, University of Zurich, Zurich, Switzerland  
 63. Jeffrey J. Hébert, University of New Brunswick, Fredericton, Canada  
 64. Bue Hesby, University of Southern Denmark, Odense, Denmark  
 65. Lise Hestbæk, University of Southern Denmark and Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark  
 66. Sheilah Hogg-Johnson, Canadian Memorial Chiropractic College, Toronto, Canada  
 67. Maria A. Hondras, University of Kansas Medical Center, Kansas City, USA  
 68. Margaux Honoré, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France  
 69. Samuel Howarth, Canadian Memorial Chiropractic College, Toronto, Canada  
 70. H. Stephen Injeyan, Canadian Memorial Chiropractic College, Toronto, Canada  
 71. Stanley Innes, Murdoch University, Perth, Australia  
 72. Pernille Marie Irgens, University of Oslo, Oslo, Norway  
 73. Craig Jacobs, Canadian Memorial Chiropractic College, Toronto, Canada  
 74. Hazel Jenkins, Macquarie University, Sydney, Australia  
 75. Alan Jenks, Vrije University, Amsterdam, The Netherlands  
 76. Tue Secher Jensen, University of Southern Denmark and Silkeborg Regional Hospital, Odense, Denmark  
 77. Melker Johansson, University of Southern Denmark, Odense, Denmark  
 78. Alice Kongsted, University of Southern Denmark and Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark  
 79. Deborah Kopansky-Giles, Canadian Memorial Chiropractic College, Toronto, Canada  
 80. Rikke Kryger, University of Southern Denmark and Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark  
 81. Arnaud Lardon, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France  
 82. Henrik Hein Lauridsen, University of Southern Denmark, Odense, Denmark  
 83. Brent Leininger, University of Minnesota, Minneapolis, USA  
 84. Nadège Lemeunier, Institut Franco-Européen de Chiropraxie, Toulouse, France  
 85. Christine Le Scanff, Université Paris-Saclay, Orsay, France  
 86. Eugene A. Lewis, Duke University School of Medicine, Durham, USA  
 87. Kathleen Linaker, Western Technical College, La Crosse, USA  
 88. Lise Lothe, Private Practice, Grimstad, Norway  
 89. Andrée-Anne Marchand, Université du Québec à Trois-Rivières, Trois-Rivières, Canada  
 90. David McNaughton, Macquarie University, Sydney, Australia  
 91. Anne-Laure Meyer, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France  
 92. Peter Miller, AECC University College, Bournemouth, England  
 93. Anne Mølgaard, University of Southern Denmark, Odense, Denmark  
 94. Craig Moore, Macquarie University, Sydney, Australia  
 95. Donald R. Murphy, Brown University, Providence, USA  
 96. Corrie Myburgh, University of Southern Denmark, Odense, Denmark  
 97. Birgitte Myhrvold, University of Oslo, Oslo, Norway  
 98. Dave Newell, AECC University College, Bournemouth, UK  
 99. Genevieve Newton, University of Guelph, Guelph, Canada  
 100. Casper Nim, University of Southern Denmark and Spine Center of Southern Denmark, Odense, Denmark  
 101. Margareta Nordin, New York University, New York, USA  
 102. Luana Nyiro, University of Zurich, Zurich, Switzerland  
 103. Søren O'Neill, University of Southern Denmark and Spine Center of Southern Denmark, Odense, Denmark  
 104. Cecilie Øverås, University of Southern Denmark, Odense, Denmark  
 105. Isabelle Pagé, Université du Québec à Trois-Rivières, Trois-Rivières, Canada  
 106. Mégane Pasquier, Institut Franco-Européen de Chiropraxie, Toulouse, France  
 107. Charles W. Penza, Miami Veterans Administration Medical Center, Miami, USA  
 108. Stephen M. Perle, University of Bridgeport, Bridgeport, USA  
 109. Mathieu Picchiottino, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France  
 110. Mathieu Piché, Université du Québec à Trois-Rivières, Trois-Rivières, Canada  
 111. Erik Poulsen, University of Southern Denmark, Odense, Denmark  
 112. Jeffrey Quon, University of British Columbia, Vancouver, Canada  
 113. Tim Raven, University of Oslo, Oslo, Norway  
 114. Mana Rezai, Centre for Disability Prevention and Rehabilitation at Ontario Tech University and CMCC Toronto, Canada  
 115. Eric J. Roseen, Boston University School of Medicine, Boston, MA, USA  
 116. Sidney Rubinstein, Vrije University, Amsterdam, The Netherlands  
 117. Louis-Rachid Salmi, Université de Bordeaux, Inserm and CHU de Bordeaux, France  
 118. Petra Schweinhardt, University of Zurich, Zurich, Switzerland  
 119. Heather M. Shearer, University of Toronto, Toronto, Canada  
 120. Laura Sirucek, University of Zurich, Zurich, Switzerland  
 121. Delphine Sorondo, Institut Franco-Européen de Chiropraxie, Toulouse, France  
 122. Paula J. Stern, Canadian Memorial Chiropractic College, Toronto, Canada  
 123. Joel Stevans, University of Pittsburgh, Pittsburgh, USA  
 124. Mette Jensen Stochkendahl, University of Southern Denmark and Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark  
 125. Kent Stuber, Canadian Memorial Chiropractic College, Toronto, Canada  
 126. Maja Stupar, Canadian Memorial Chiropractic College, Toronto, Canada  
 127. John Srbely, University of Guelph, Guelph, Canada  
 128. Michael Swain, Macquarie University, Sydney, Australia  
 129. Julita Teodorczyk-Injeyan, Canadian Memorial Chiropractic College, Toronto, Canada  
 130. Jean Thérout, Murdoch University, Perth, Australia  
 131. Haymo Thiel, AECC University College, Bournemouth, UK  
 132. Lars Uhrenholt, University of Aarhus, Aarhus, Denmark  
 133. Anneke Verbeek, Private practice, Ghent, Belgium  
 134. Leslie Verville, Ontario Tech University, Oshawa, Canada  
 135. Karl Vincent, Institut Franco-Européen de Chiropraxie, Ivry-sur-Seine, France  
 136. Andrew L. Vitiello, CQUUniversity, Sydney, Australia  
 137. Dan Wang, Ontario Tech University, Oshawa, Canada  
 138. Kenneth A. Weber, Stanford University School of Medicine, Palo Alto, USA  
 139. James M. Whedon, Southern California University of Health Sciences, Whittier, USA  
 140. Jessica Wong, University of Toronto, Toronto, Canada  
 141. Francesca Wuytack, Trinity College, Dublin, Ireland  
 142. James Young, University of Southern Denmark, Odense, Denmark  
 143. Hainan Yu, Ontario Tech University, Oshawa, Canada  
 144. Dorte Ziegler, University of Southern Denmark and Spine Center of Southern Denmark, Odense, Denmark  
 145. Kristina Boe Dissing, University of Southern Denmark, Odense, Denmark

#### Authors' contributions

All authors (Pierre Côté, André Bussièrès, J. David Cassidy, Jan Hartvigsen, Greg Kawchuk, Charlotte Leboeuf-Yde, Silvano Mior, Mike Schneider) developed, wrote, edited and proofread the commentary. All signatories reviewed the commentary and endorsed its content. The author(s) read and approved the final manuscript.

#### Funding

No funding was obtained for this commentary.

#### Availability of data and materials

Not applicable.

#### Ethics approval and consent to participate

Not applicable.

#### Consent for publication

Not applicable.

#### Competing interests

PC reports research grants unrelated to this work from Aviva Canada, Canadian Institutes of Health Research-Canada Research Chair Program, Canadian chiropractic Association, Canadian Chiropractic Research Foundation, College of Chiropractors of British Columbia, Et liv i bevægelse" (ELIB), French Chiropractic Association, Financial Services Commission of Ontario, Ontario Ministry of Finance, Ontario Trillium Foundation; travel expenditures unrelated to this work from Griffith University - Whiplash Symposium 2017,



Eurospine, Southern Denmark University, Institut Franco-Europeen de Chiropraxie, Karolinska Institutet, North American Spine Society, University of Quebec-Trois-Rivieres, University of Zurich, World Federation of Chiropractic; fees medical-legal expertise from the Canadian Chiropractic Protective Association. He is the Chair of the World Federation of Chiropractic Research Disability and Rehabilitation Committee. AB reports research grants unrelated to this work from University of Quebec-Trois-Rivieres, McGill University, Centre de recherche interdisciplinaire en réadaptation du Montréal métropolitain, Canadian Institutes of Health Research; fees medical-legal expertise from the Canadian Chiropractic Protective Association. GNK reports active research grants unrelated to this work from The Natural Sciences and Engineering Research, The National Institutes of Health, The Alberta Spine Foundation, The American Orthotic and Prosthetic Association, The New Frontiers in Research Fund and the Canadian Chiropractic Research Foundation. Travel expenditures unrelated to this work in the past year include Kiropraktik i Sverige Live, Et liv i bevægelse (ELIB), the Nordic Institute of Chiropractic and Clinical Biomechanics, The American Chiropractic Association, The National Institutes of Health, The British Columbia Chiropractic Association, and The World Federation of Chiropractic. He is the Chair of the World Federation of Chiropractic Research Council. Fees for medical-legal expertise unrelated to this work from the Canadian Chiropractic Protective Association. JH reports that he holds multiple research grants from Danish and international funding agencies and charities. He has received coverage of travel expenditures from multiple sources internationally in connection with speaking engagements. Within the past year he has received speaking fees from Parker Seminars and Novartis. He is member of the World Federation of Chiropractic Research Council. SM reports research grants unrelated to this work from Ontario Chiropractic Association, Canadian Chiropractic Association, and Canadian Spinal Research Foundation. MS reports support from research grants unrelated to this work from the National Institutes of Health, Patient Centered Outcomes Research Institute, University of Pittsburgh and NCMIC Foundation; honoraria from NCMIC speaker's bureau; fees from medico-legal consulting services. JDC and CLY declare that they have no competing interests.

#### Author details

<sup>1</sup>Faculty of Health Sciences, Ontario Tech University, Oshawa, Canada. <sup>2</sup>Centre for Disability Prevention and Rehabilitation at Ontario Tech University and CMCC, Oshawa, Canada. <sup>3</sup>Division of Epidemiology, Dalla Lana School of Public Health, University of Toronto, Toronto, Canada. <sup>4</sup>Département chiropratique, Université du Québec à Trois-Rivières, Trois-Rivières, Canada. <sup>5</sup>School of Physical and Occupational Therapy, Faculty of Medicine McGill University, Montreal, Canada. <sup>6</sup>Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense, Denmark. <sup>7</sup>Nordic Institute of Chiropractic and Clinical Biomechanics, Odense, Denmark. <sup>8</sup>Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, Canada. <sup>9</sup>Institute for Regional Health Research, University of Southern Denmark, Odense, Denmark. <sup>10</sup>Canadian Memorial Chiropractic College, Toronto, Canada. <sup>11</sup>School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, USA. <sup>12</sup>Clinical and Translational Science Institute, University of Pittsburgh, Pittsburgh, USA.

Received: 6 April 2020 Accepted: 15 April 2020

Published online: 04 May 2020

#### References

- World Health Organization. Q&A on coronaviruses (COVID-19). 2020. <https://www.who.int/news-room/q-a-detail/q-a-coronaviruses>.
- World Health Organization. Coronavirus disease (COVID-19) advice for the public: Myth busters. 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>.
- World Federation of Chiropractic. Coronavirus Disease 2019 (COVID-19). Advice for chiropractors. 2020. [http://www.wfc.org/website/images/wfc/Latest\\_News\\_and\\_Features/Coronavirus\\_statement\\_2020\\_03\\_17.pdf](http://www.wfc.org/website/images/wfc/Latest_News_and_Features/Coronavirus_statement_2020_03_17.pdf).
- International Chiropractors Association. Immune function and chiropractic what does the evidence provide? 2020. <http://www.chiropractic.org/wp-content/uploads/2020/03/ICA-Report-on-Immune-Function-and-Chiropractic-3-20-20.pdf>.
- International Chiropractors Association. Immune function and chiropractic what does the evidence provide? 2020. <http://www.chiropractic.org/wp-content/uploads/2020/03/Updated-Report-of-3-28-wtih-fixed-biblio.pdf>.

- Picchiottino M, Leboeuf-Yde C, Gagey O, Hallman DM. The acute effects of joint manipulative techniques on markers of autonomic nervous system activity: a systematic review and meta-analysis of randomized sham-controlled trials. *Chiropr Man Therap*. 2019;27:17.
- Goncalves G, Le Scanff C, Leboeuf-Yde C. Effect of chiropractic treatment on primary or early secondary prevention: a systematic review with a pedagogic approach. *Chiropr Man Therap*. 2018;26:10.
- Clar C, Tsertsvadze A, I Court R, Hundt GL, Clarke A, Sutcliffe P. Clinical effectiveness of manual therapy for the management of musculoskeletal and non-musculoskeletal conditions: systematic review and update of UK evidence report. *Chiropr Man Therap*. 2014;22:12.
- Lilienfeld SO, Ammirati R, David M. Distinguishing science from pseudoscience in school psychology: science and scientific thinking as safeguards against human error. *J Sch Psychol*. 2012;50:7–36.
- Teodorczyk-Injeyan JA, et al. Elevated production of nociceptive CC chemokines and sE-selectin in patients with low back pain and the effects of spinal manipulation: a nonrandomized clinical trial. *Clin J Pain*. 2018;34:68–75.
- Teodorczyk-Injeyan JA, Injeyan HS, Ruegg R. Spinal manipulative therapy reduces inflammatory cytokines but not substance P production in normal subjects. *J Manip Physiol Ther*. 2006;29:14–21.
- Peters DH, Tran NT, Adam T. Implementation research in health: a practical guide. Alliance for Health Policy and Systems Research, World Health Organization; 2013.
- White Junod. FDA and clinical drug trials: a short history. 2020. <https://www.fda.gov/media/110437/download>.
- World Health Organization, 2020. Coronavirus disease (COVID-19) technical guidance: patient management. 2020. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/patient-management>.

#### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Ready to submit your research? Choose BMC and benefit from:**

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

**At BMC, research is always in progress.**

Learn more [biomedcentral.com/submissions](https://biomedcentral.com/submissions)

