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The prevalence and determinants of physical activity promotion by Australian chiropractors: A cross sectional study

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ABSTRACT

Background: Approximately one in four adults do not meet the World Health Organisation physical activity recommendations. While health promotion (i.e., physical activity) is common within chiropractic settings, little is known about chiropractors discussing this public health issue with their patients. The aim of our study is to examine the prevalence and characteristics of Australian chiropractors who frequently discuss patient physical activity.

Methods: A national cross-sectional survey of chiropractors focusing upon practitioner characteristics, practice settings and clinical management characteristics. Regression analyses were conducted on 1924 survey respondents to identify factors associated with practitioners who frequently discuss physical activity with patients.

Results: Eighty-five percent of Australian chiropractors reported 'often' discussing physical activity as part of their patient management. The strongest factors associated with chiropractors who frequently discuss physical activity obtained from the multivariate analysis include: often discussing occupational health and safety (odds ratio [OR] = 6.10; 95%CI: 3.88, 9.59), often discussing diet/nutrition (OR = 4.56; 95%CI: 3.12, 6.66), often discussing smoking/drugs/alcohol (OR = 4.41; 95%CI: 2.06, 9.40), often use of specific exercise therapy/rehabilitation/injury taping (OR = 3.76; 95%CI: 2.62, 5.39) and often caring for athletes or sports people (OR = 2.18; 95%CI: 1.56, 3.06) within their practice setting.

Conclusion: Discussing physical activity is a frequent feature of patient management among most chiropractors in Australia. The association between these practitioners and discussion of other costly public health burdens could suggest chiropractors have a valuable role to play in chronic disease prevention. Given the growing need for practitioner-led promotion of patient physical activity further research examination of the role and contribution of chiropractors in promoting this important public health topic among patients and communities is needed.

1. Background

Physical inactivity is a major worldwide epidemic, associated with an increased risk of all-cause mortality.[1,2] As the fourth leading modifiable cause of disease burden,[3] physical inactivity is responsible for up to 10% of non-communicable diseases, including coronary heart disease, type 2 diabetes and a range of cancers.[4] For chronic disease prevention, the World Health Organisation recommends 150 min of moderate-intensity physical activity per week, or 75 min per week of vigorous-intensity physical activity, as well as muscle strengthening activities twice per week.[5] Despite the numerous health benefits associated with physical activity, these recommendations are not being met. In Australia for instance, health surveys point towards a decline in leisure time physical activity and a lack of improvement in inactivity

Abbreviations: ACORN, Australian Chiropractic Research Network; PBRN, practice-based research network; AHPRA, Australian Health Practitioner Regulation Agency

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levels in the last two decades.[6] Only 15% of Australian adults currently meet the full national physical activity guidelines that consist of moderate-to-vigorous activity five times per week and strength training twice per week.[7–9] Further, only 7% of children are getting one hour of exercise per day.[7]

Physical activity uptake is an important public health goal in many countries. The World Health Organisation recognises the global impact of physical inactivity and has launched a worldwide plan to reduce it by 10% by 2025 and 15% by 2030.[10] Health care providers can play an integral role in communicating this public health information in the patient care setting.[11] The chiropractic profession represents a substantial component of the Australian allied health care system with chiropractors managing an estimated 21.3 million patient visits per year.[12] While chiropractors are trained and educated in the diagnosis and management of a broad range of musculoskeletal conditions, [13] they are also recognised as advocates for active lifestyle, general wellness and health promotion, [12,14–16] with at least 90% prescribing or advising on physical activity or exercise in their consultations.[12,14,17–20] People seeking chiropractic care for back complaints are also more likely to have poorer health and report several chronic diseases,[21–23] compared to the general population.[3]

Evidence suggests the implementation of physical activity interventions has a favourable impact on pain severity, mental health, physical functioning[24] and chronic diseases[25] while at the same time is unlikely to cause any adverse effects.[24] The chiropractic profession is well positioned in the community to promote physical activity, particularly for those people with musculoskeletal complaints. Yet, the role that these providers play in influencing such behaviour and lifestyle-related risk factors remains under researched. In direct response to this significant gap, this paper reports findings from a study examining the practitioner, practice and patient management characteristics of Australian chiropractors who regularly discuss physical activity with their patients.

2. Methods

2.1. Sample

This paper reports analyses from a workforce questionnaire distributed as part of the Australian Chiropractic Research Network (ACORN) project – a national voluntary chiropractic practice-based research network (PBRN) database. Details regarding the ACORN project recruitment, promotion strategy, and participants have been reported elsewhere,[12,26,27] but briefly, 2005 practising chiropractors across Australia completed and returned the practitioner database questionaire between March and July 2015, representing a response rate of 43%. The participating ACORN project sample has been shown to be generally representative of the wider Australian chiropractic profession in terms of age, gender, and practice location in comparison with the total population of chiropractors[12] as registered by the Australian Health Practitioner Regulation Agency (AHPRA).[28] The ACORN project was approved by the Human Research Ethics Committee of the University of Technology Sydney (#2014000027).

2.2. Questionnaire

2.2.1. Dependent variable: physical activity discussion

This 21-item workforce questionnaire addresses three key areas of chiropractic practitioner characteristics, practice characteristics, and clinical management approaches. The participants were asked about how often they discuss physical activity with their patients via the question: "*Indicate the frequency with which you discuss the following [physical activity] as part of your care/management plans*" with the response options of "never", "rarely", "sometimes", and "often". The responses were recoded into two categories: discussing physical activity 'often' and 'not often' which included the original answer options 'never', 'rarely', and 'sometimes'.

2.2.2. Independent variables: demographic and practice characteristics

The questionnaire collected information regarding age, gender, highest professional qualifications, and working years in chiropractic private practice. The practice characteristics section collected data on average patient care hours and number of patient visits per week, practice location, other health professionals working in the same practice location, professional referral relationships, and the use of diagnostic imaging. In addition, participants were asked about their clinical management, including: discussion of other public health related topics (in addition to and distinct from physical activity) with their patients; frequency of treating patients amongst a range of patient subgroups and presenting with a range of conditions, and the use of a range of musculoskeletal interventions and other therapeutic techniques in their patient management.

2.3. Statistical analyses

Statistical analyses were conducted using the statistical software Stata 13.1. Bivariate logistic regression analysis was used to determine the associations of physical activity discussion with demographic and practice characteristics. A backward stepwise multivariate logistic regression was used to identify the most important independent predictors of chiropractors who 'often' discuss physical activity or fitness with their patients as part of their management plans. All variables associated with the use of physical activity or fitness advice in patient care via the initial bivariate analyses at a p-value of ≤ 0.25 were entered into the regression model.[29] Then during the stepwise process, if the corresponding cofficient of of a variable had a p-value > 0.05, the variable was removed from the model. Both crude and adjusted odds ratio (OR) with 95% confidence interval (95% CI) were estimated separately for each independent variable.

3. Results

Of the 1924 (96.0%) chiropractors who responded to the question regarding the frequency with which they discussed physical activity with their patients, 1634 (84.9%) chiropractors reported that they often discussed physical activity as part of their management plans.

Table 1 shows the practitioner characteristics of participating chiropractors who discuss physical activity as a part of their patient care via bivariate regression analyses. The mean (SD) age and the mean (SD)

Table 1
Practitioner characteristics of chiropractors who discuss physical activity as part of patient care.

Independent variable	Dependent variable				
	Not often n = 290	Often n = 1634	Crude Odds Ratio	95% CI	p
Age in years *mean ± sd*	43.4 ± 13.4	42.0 ± 11.8	0.99	0.98-1.00	0.065
Gender *n (%)*			1.15	0.89-1.50	0.285
Male	189 (65.2%)	1006 (61.9%)			
Female	101 (34.8%)	620 (38.1%)			
Qualification *n (%)*			1.04	0.90-1.19	0.339
Diploma	11 (3.8%)	42 (2.6%)			
Bachelor	94 (32.6%)	574 (35.4%)			
Doctor of Chiropractic	95 (33.0%)	467 (28.8%)			
Master's degree	87 (30.2%)	526 (32.4%)			
PhD	1 (0.4%)	14 (0.9%)			
Years in practice *mean ± sd*	17.2 ± 12.8	15.6 ± 11.0	0.99	0.98-1.00	0.037

Table 2
Chiropractic practice characteristics regarding discussion about physical activity as part of patient care.

Independent variable	Dependent variable				
	Not often n = 290	Often n = 1634	Crude Odds Ratio	95% CI	p
Patient care hours per week *mean ± sd*	26.0 ± 10.3	27.7 ± 16.5	1.01	1.00-1.02	0.085
Patient visits per week *mean ± sd*	88.5 ± 56.1	87.3 ± 57.8	1.00	0.99-1.01	0.752
Location *n (%)*			1.54	1.16-2.05	0.003
Urban	185 (69.0%)	1194 (77.4%)			
Rural & remote	83 (31.0%)	348 (22.6%)			
One practice location only *n (%)*	219 (75.5%)	1220 (74.9%)	1.03	0.77-1.38	0.821
Other health professionals active in the practice location *n (%)*					
General practitioner	26 (9.0%)	96 (5.9%)	0.63	0.40-1.00	0.048
Psychologist/counsellor	39 (13.5%)	200 (12.2%)	0.90	0.62-1.30	0.565
Physiotherapist	30 (10.3%)	148 (9.1%)	0.86	0.57-1.31	0.486
Occupational therapist	8 (2.8%)	40 (2.5%)	0.88	0.41-1.91	0.755
Podiatrist	27 (9.3%)	153 (9.4%)	1.01	0.65-1.55	0.977
Medical specialist	11 (3.8%)	411 (2.5%)	0.65	0.33-1.29	0.217
Exercise physiologist	13 (4.5%)	112 (6.9%)	1.57	0.87-2.82	0.134
Another chiropractor	137 (47.2%)	983 (60.2%)	1.69	1.31-2.17	< 0.001
Referral relationships *n (%)*					
General practitioner	134 (46.2%)	958 (58.6%)	1.65	1.28-2.12	< 0.001
Psychologist/counsellor	25 (8.6%)	250 (15.3%)	1.91	1.24-2.95	0.003
Physiotherapist	67 (23.1%)	541 (33.1%)	1.65	1.23-2.21	0.001
Occupational therapist	18 (6.2%)	143 (8.8%)	1.45	0.87-2.41	0.151
Podiatrist	79 (27.2%)	682 (41.7%)	1.91	1.45-2.52	< 0.001
Medical specialist	29 (10.0%)	279 (17.1%)	1.85	1.24-2.78	0.003
Exercise physiologist	21 (7.2%)	279 (17.1%)	2.64	1.66-4.19	< 0.001
None	82 (28.3%)	321 (19.7%)	0.62	0.47-0.82	0.001
Using imaging (used often) *n (%)*	119 (41.3%)	791 (48.7%)	1.35	1.04-1.73	0.022
Treating the following patient subgroups (treated often) *n (%)*					
Older people (65 years or over)	193 (70.2%)	1197 (74.0%)	1.21	0.91-1.60	0.182
Aboriginal and Torres Strait Islander people	4 (1.5%)	29 (1.8%)	1.25	0.44-3.60	0.673
Pregnant women	74 (26.9%)	619 (38.4%)	1.70	1.27-2.25	< 0.001
Athletes or sports people	71 (25.9%)	859 (53.5%)	3.29	2.47-4.38	< 0.001
People with work-related injuries	64 (23.7%)	606 (38.4%)	2.01	1.49-2.70	< 0.001
People with traffic-related injuries	25 (9.2%)	227 (14.4%)	1.65	1.07-2.56	0.023
People receiving post-surgical rehabilitation	9 (3.3%)	110 (7.0%)	2.19	1.10-4.37	0.026
Non-English-speaking ethnic groups	16 (6.1%)	101 (6.6%)	1.09	0.63-1.88	0.756

working years in chiropractic practice of chiropractors who often discuss physical activity with patients were 42.0 (11.8) years and 15.6 (11.0) years, respectively. Amongst these chiropractors, 61.9% were male and 32.4% had Master's degree in chiropractic. Chiropractors who often discuss physical activity with patients were more likely to have less working years in private chiropractic practice than those who do not often discuss activity with their patients (p = 0.04). However, age, gender, and qualification of chiropractors were not statistically significantly associated with their frequency of physical activity discussion with patients.

The practice characteristics of participating chiropractors who discuss physical activity as part of patient care via bivariate regression analyses are shown in Table 2. Chiropractors practicing in urban locations were more likely to often discuss physical activity with patients (crude OR = 1.54; 95%CI: 1.16, 2.05; p = 0.003). Chiropractors often using diagnostic imaging were more likely to often discuss physical activity with patients (crude OR = 1.35; 95%CI: 1.04, 1.73; p = 0.022). Chiropractors who work alongside another chiropractor at their practice location were more likely to often discuss physical activity with patients (crude OR = 1.69; 95%CI: 1.31, 2.17; p < 0.001), while those who work with a general practitioner (GP) at their practice location were less likely to often discuss physical activity with patients (crude OR = 0.63; 95%CI: 0.40, 1.00; p = 0.048). Chiropractors who often discuss physical activity with patients were more likely to have referral relationship with other health professionals. Specifically, chiropractors who have referral relationships with a GP, a psychologist/counsellor, a physiotherapist, a podiatrist, a medical specialist, and/or an exercise physiologist were significantly associated with frequent physical activity discussions in patient care (crude OR range: 1.45–2.64; all p < 0.005). In addition, chiropractors who often treat pregnant women, athletes/sports people, people with work-related and traffic-related injuries, and/or people receiving post-surgical rehabilitation were significantly associated with frequent physical activity discussions in patient care (crude OR range: 1.65–3.29; all p < 0.05).

With regards to clinical management (Table 3), in the univariate analysis, chiropractors who often discuss physical activity with patients were also more likely to often discuss diet/nutrition (crude OR = 6.30; 95% CI: 4.56, 8.70), smoking/drugs/alcohol (crude OR = 13.81; 95% CI: 6.78, 28.11), occupational health and safety (crude OR = 8.24; 95% CI: 5.48, 12.39), pain counselling (crude OR = 3.97; 95% CI: 2.57, 6.11), nutritional supplements (crude OR = 3.03; 95% CI: 2.21, 4.14), and/or medications with patients (crude OR = 3.26; 95% CI: 2.16, 4.93) (all p < 0.001). There was statistical differences between chiropractors who often and not often discuss physical activity with patients regarding the frequently delivered treatment of axial (crude OR = 3.59; 95% CI: 2.41, 5.34) or referred/radicular (crude OR = 1.65; 95% CI: 1.28, 2.13) neck pain, axial thoracic pain (crude OR = 2.35; 95% CI: 1.73, 3.18), axial (crude OR = 3.82; 95% CI: 2.50, 5.84) or referred/radicular (crude OR = 1.90; 95% CI: 1.42, 2.54) back pain, lower (crude OR = 1.96; 95% CI: 1.52, 2.54) or upper (crude OR = 2.10; 95% CI:1.63, 2.72) limb musculoskeletal conditions, postural disorders (crude OR = 2.82; 95% CI: 2.17, 3.68), degenerative spine conditions (crude OR = 2.19; 95% CI: 1.68, 2.84), headache (crude OR = 2.21; 95% CI:1.60, 3.07), or spinal health maintenance/prevention (crude OR = 1.81; 95% CI: 1.38, 2.38) (all p < 0.001). The frequent use of chiropractic techniques such as high velocity low amplitude manipulation (crude OR = 1.73; 95% CI: 1.28, 2.34), extremity manipulation (crude OR = 1.86; 95% CI: 1.44, 2.41), soft tissue therapy (crude OR = 1.87; 95% CI: 1.44, 2.42), or specific exercise therapy/rehabilitation/injury taping (crude OR = 4.74; 95% CI: 3.47, 6.47)

Table 3
Clinical management regarding discussion about physical activity as part of patient care.

Independent variable	Dependent variable				
	Not often n = 290	Often n = 1634	Crude Odds Ratio	95% CI	p
Discussed as part of the care/management plan (done often) *n (%)*					
Diet/nutrition	49 (17.1%)	921 (56.5%)	6.30	4.56-8.70	< 0.001
Smoking/drugs/alcohol	8 (2.8%)	465 (28.6%)	13.81	6.78-28.11	< 0.001
Occupational health and safety	27 (9.5%)	755 (46.5%)	8.24	5.48-12.39	< 0.001
Pain counselling	24 (8.7%)	442 (27.3%)	3.97	2.57-6.11	< 0.001
Nutritional supplements	53 (18.3%)	659 (40.5%)	3.03	2.21-4.14	< 0.001
Medications	27 (9.5%)	414 (25.6%)	3.26	2.16-4.93	< 0.001
Treating patients with the following conditions (done often) *n (%)*					
Neck pain (axial)	237 (84.6%)	1543 (95.2%)	3.59	2.41-5.34	< 0.001
Neck pain (referred/radicular)	147 (52.5%)	1048 (64.6%)	1.65	1.28-2.13	< 0.001
Thoracic pain (axial)	202 (73.5%)	1402 (86.7%)	2.35	1.73-3.18	< 0.001
Thoracic pain (referred/radicular)	115 (41.8%)	760 (47.3%)	1.25	0.96-1.62	0.093
Low back pain (axial)	241 (86.4%)	1552 (96.0%)	3.82	2.50-5.84	< 0.001
Low back pain (referred/radicular)	199 (71.3%)	1335 (82.6%)	1.90	1.42-2.54	< 0.001
Lower limb musculoskeletal disorders	129 (46.2%)	1017 (62.8%)	1.96	1.52-2.54	< 0.001
Upper limb musculoskeletal disorders	131 (47.1%)	1053 (65.2%)	2.10	1.63-2.72	< 0.001
Postural disorders	108 (39.7%)	1028 (65.0%)	2.82	2.17-3.68	< 0.001
Degenerative spine conditions	132 (48.7%)	1067 (67.5%)	2.19	1.68-2.84	< 0.001
Headache disorders	213 (78.0%)	1406 (88.7%)	2.21	1.60-3.07	< 0.001
Migraine disorders	123 (45.1%)	861 (54.3%)	1.45	1.12-1.88	0.005
Spinal health maintenance/prevention	169 (62.4%)	1187 (75.0%)	1.81	1.38-2.38	< 0.001
Non-musculoskeletal disorders	51 (25.8%)	357 (30.5%)	1.27	0.90-1.78	0.175
Using the following techniques/methods (used often) *n (%)*					
Drop-piece techniques/Thompson or similar	139 (50.7%)	868 (54.3%)	1.15	0.89-1.49	0.276
Biomechanical pelvic blocking/Sacro-Occipital technique	94 (34.7%)	728 (45.6%)	1.58	1.20-2.06	0.001
Instrument adjusting	129 (46.9%)	851 (53.1%)	1.28	0.99-1.66	0.058
Chiropractic biophysics	16 (6.2%)	60 (3.9%)	0.63	0.35-1.10	0.105
High velocity low amplitude adjustment/manipulation	205 (74.8%)	1344 (83.7%)	1.73	1.28-2.34	< 0.001
Applied kinesiology	51 (18.9%)	246 (15.6%)	0.79	0.57-1.11	0.176
Flexion-distraction	17 (6.3%)	128 (8.2%)	1.31	0.78-2.22	0.309
Functional neurology	24 (9.1%)	216 (13.9%)	1.61	1.03-2.51	0.035
Extremity manipulation	125 (45.8%)	981 (61.2%)	1.86	1.44-2.41	< 0.001
Musculoskeletal interventions (used often) *n (%)*					
Dry needling/acupuncture	20 (7.3%)	238 (14.9%)	2.21	1.37-3.55	0.001
Soft tissue therapy, trigger point therapy, massage therapy	148 (53.6%)	1103 (68.3%)	1.87	1.44-2.42	< 0.001
Electro-modalities	17 (6.2%)	165 (10.3%)	1.75	1.05-2.94	0.033
Heat/cryotherapy	27 (9.9%)	285 (17.8%)	1.99	1.31-3.01	0.001
Orthotics	21 (7.7%)	167 (10.4%)	1.40	0.87-2.25	0.164
Specific exercise therapy/rehabilitation/injury taping	55 (20.1%)	867 (54.3%)	4.74	3.47-6.47	< 0.001

were significantly associated with the frequent physical activity discussion with chiropractic patients (all $p < 0.001$).

A total of 56 variables were initially entered into the multivariate model and seven variables were included in the final multivariate model. Multivariable logistic regression analyses identified seven factors that were independently associated with the likelihood of a chiropractor often discussing physical activity as part of patient care (Table 4). Such factors included frequently discussing occupational health and safety (adjusted OR = 6.10; 95%CI: 3.88, 9.59, $p < 0.001$); diet/nutrition (adjusted OR = 4.56; 95%CI: 3.12, 6.66, $p < 0.001$) and smoking/drugs/alcohol (adjusted OR = 4.41; 95%CI: 2.06, 9.40, $p < 0.001$). Other factors included frequently using specific exercise therapy/rehabilitation/injury taping (adjusted OR = 3.76; 95%CI: 2.62, 5.39, $p < 0.001$); frequently treating athletes or sports people (adjusted OR = 2.18; 95%CI: 1.56, 3.06, $p < 0.001$) and frequently treating spinal health maintenance/prevention (adjusted OR = 1.43; 95%CI: 1.03, 1.99, $p = 0.034$). However, the lack of referral relationship with other health care practitioners was negatively associated with often discussing physical activity with patients (adjusted OR = 0.57; 95%CI: 0.40, 0.82, $p = 0.002$).

4. Discussion

Drawing upon a national representative sample, our study highlights a significant number of public health issues related to everyday chiropractic consultation. Notably, 5 out of every 6 Australian chiropractors incorporate physical activity discussions as part of their clinical management.

Our study found chiropractors who often discuss physical activity are more likely to often discuss occupational health and safety as part of

Table 4
Factors associated with chiropractors who frequently discuss physical activity as part of patient care.

Variable	Adjusted Odds ratio	95% CI	p
Discussing occupational health and safety with patients (often)	6.10	3.88-9.59	< 0.001
Discussing diet/nutrition with patients (often)	4.56	3.12-6.66	< 0.001
Discussing smoking/drugs/alcohol with patients (often)	4.41	2.06-9.40	< 0.001
Using specific exercise therapy/rehabilitation/injury taping (often)	3.76	2.62-5.39	< 0.001
Treating athletes or sports people (often)	2.18	1.56-3.06	< 0.001
Treating spinal health maintenance/prevention (often)	1.43	1.03-1.99	0.034
No professional referral relationship with other practitioners	0.57	0.40-0.82	0.002

their patient care than those who do not often discuss physical activity. Engagement in physical activity has known protective effects on work-related musculoskeletal injuries.[30] However, an increasing proportion of the workforce have occupations that are sedentary, i.e., sitting[31] and coupled with low levels of physical activity, is associated with poor health, productivity losses, job dissatisfaction, absence and high turnover.[32] As such, it is not too surprising that almost half of the chiropractors surveyed in our study were likely to discuss physical activity *and* occupational health and safety. Previous literature suggests chiropractors promote safe work environments by conducting worksite assessments[33] and knowingly discuss workplace injury and ergonomic stress on occupational 'at-risk' patients.[14,20] However a discussion on the increased sitting habits in the work setting[34] – now the largest contributors to daily sedentary time in workers[35] – is unknown. Further, whether chiropractors discuss and prescribe specific exercises (i.e., strengthening activities) as part of their physical activity promotion in the workplace is yet to be determined. Given that prolonged sitting is associated with an increased risk of various chronic diseases and premature mortality,[36] the workplace is a key environment to discuss physical activity alongside occupational health and safety, and should be further investigated.

Our study found chiropractors who often discuss physical activity are also more likely to often discuss diet/nutrition as part of their patient management. One reason for these shared discussions may relate to the relationship between physical activity and nutrition, with those who are physical inactive generally more likely to adopt poor nutritional habits.[37] For instance, sedentary activity such as watching television has been shown to overlap with the consumption of excessive, unhealthy foods in both youth[38] and adults.[39] In Australia, few adults meet the fruit and vegetable intake guidelines,[40] with a dominance of excessive calorie dense, ultra-processed food intake, posing a risk for heart disease, type 2 diabetes[3] and several cancers.[41] Approximately 55% of chiropractors discussed diet/nutrition in relation to physical activity in our study, however the nature of these discussions was not explored. While recent evidence suggests chiropractic diet/nutrition advice likely relates to nutritional supplement intake,[42] it is possible that our findings may relate to previous Australian literature, which suggests that a high percentage of chiropractors prefer health information brochures (such as information on nutritional supplements) over direct one-on-one diet/nutrition consultation.[43] Increased work demands and unpaid time required to pursue in-depth diet/nutrition therapy or counselling by chiropractors are possible reasons for this form of consultation.[43,44] It maybe that Australian chiropractors in our study also lack the time and/or knowledge of nutritional guideline advice and may simply refer to dietary professionals. This issue should be clarified with further investigation.

In our study, discussing smoking/drugs/alcohol frequently was another factor independently associated with chiropractors often discussing physical activity with patients.[42] Poor patient health behaviors seemingly cluster together, with physical inactivity adversely influencing the addictive process associated with alcohol consumption, tobacco smoking and substance abuse.[45] Yet, physical activity participation has shown a reduction in the desire for substance abuse, cravings as well as withdrawal symptoms and relapse episodes, over an extended period of time.[46–48] Despite being modifiable lifestyle behavioural risk factors, less than 30% of chiropractors in our study discussed smoking/drugs/alcohol in relation to physical activity. While the reasons in our study were not clear, our findings are in line with a previous Australian study which showed only a small percentage of chiropractors offer information or education on smoking cessation (35%), alcohol (13%) and substance abuse (12%).[43] Possible reasons for this include chiropractors being neutral or opposed to the discussion of adverse health behaviours due to experiences of unwanted patient responses and/or the lack of time during consultation to address these lifestyle behavioural issues.[18] Another study showed chiropractors were willing to discuss lifestyle issues should the patient present with a lifestyle-related problem.[19] It is plausible that chiropractors in our study may lack adequate education or training and therefore knowledge relating to substance abuse issues. Such issues should be explored in more depth in future studies.

Treating athletes/sports people frequently was significantly associated with chiropractors who often discuss physical activity with patients in our study. This finding is not surprising, given that sport is one part of physical activity participation and chiropractors are among a wide range of health professionals, who treat athletes or sports people.[49,50] Sports injuries pose a substantial health burden[51,52] and constitute a common cause of pain and disability that can negatively impact an individual's quality of life and well-being. While physical activity is important to mitigate the risk of chronic disease and regular sports participation is likely to provide health benefits, it is also necessary to discuss physical activity in the context of a gradual return to sport, following sports injury for athletes and sports people. [53] There are both advantages (i.e., physical adaptation) and disadvantages (i.e., injury risk) associated with physical training loads on fitness.[54] In the event of injury, the decision to return to sport can be complex, requiring an individualised approach based on the athletes' circumstances.[55] Sports injury management is common among Australian chiropractors, with almost 50% frequently treating athletes or sports people.[50] Although the relationship between physical activity and treating athletes/sports people is conceivable, i.e., physical activity can effectively reduce sports and overuse injuries,[56] it is also important to ensure the athlete's functional limits and milestones are agreed upon and honoured in the rehabilitation of musculoskeletal injuries. The reasons behind the relationship between physical activity and treating athletes/sports people was not investigated in our study and warrant further research attention.

We found chiropractors who often discuss physical activity with patients were also more likely to often use specific exercise therapy/rehabilitation/injury taping. This is not an unexpected finding, given chiropractors who utilise a multimodal approach to care (i.e., the combination of manipulative therapy with exercise prescription, strengthening, stretching, soft tissue therapy, active care programs and other ancillary therapies such as proprioception training) are also more likely to promote physical activity.[49] The discussion of physical activity regarding specific exercise therapy/rehabilitation/injury taping may simply be linked to its preventative benefits,[56] along with an end goal of rehabilitation that is aimed to restore functional limitations. Finally, the possibility remains that adjunctive techniques like taping are collinearly linked to physical activity discussion in the treatment of sports people, given adjunct techniques have a therapeutic effect on the management of sports related disorders.[57,58]

While our ACORN analysis draws upon a large nationally-representative sample of Australian chiropractors, drawing strong conclusions from our research may be limited. Our study is a secondary analysis and being cross-sectional in nature, it relies on the retrospective recall of practitioners. Also, our high-quality baseline data focused on broad issues around the chiropractic workforce and was not specifically designed to provide an in-depth analyses, i.e., knowledge, education or promotion of physical activity among Australian chiropractors. Our clinical management variable included the discussion of physical activity and fitness rather than just physical activity alone, potentially over-estimated physical activity discussions by including fitness as well. Despite these limitations, our study does examine the practitioner, practice and patient management characteristics of chiropractors who regularly discuss physical activity. Our results can assist in generating hypotheses to further explore (in subsequent sub studies) what recommendations are made by chiropractors as well as their knowledge of the Australian physical activity guidelines, by assessing the delivery of physical activity educational content within the chiropractic curricula and post graduate training. For example, our data was not able to elicit information on the Australian chiropractic curriculum with respect to physical activity education, however almost 50% of Australian and New Zealand chiropractic students recently surveyed

only agree (vs. 25% who strongly agree) with physical inactivity screening in the chiropractic setting.[59] This seems to contrast practice reality, with 85% Australian chiropractors often discuss physical activity in clinical practice, suggesting there may be greater room for improvement within the student curriculum. For practitioners, greater impact may be achieved by developing an accessible physical activity framework, which includes contemporary knowledge on guideline recommendations, thus encouraging further active promotion within the chiropractic setting.[60]

5. Conclusion

Discussing physical activity is a frequent feature of patient management reported by a majority of chiropractors in Australia. Given the significance of physical activity for targeting the rising burden of non-communicable disease, the potential of practitioner-led promotion for such behaviour change and the prevalence of chiropractic care amongst the Australian population, it is important future research further examine and evaluate the role and contribution of chiropractors in promoting this important public health topic amongst patients and communities.

Ethics approval and consent to participate

This is a secondary analysis of existing ACORN data (written consent was obtained by completing the existing ACORN survey). The ethics approval number for the ACORN data collection was approved by the Human Ethics Committee, University of Technology Sydney (#2014000027).

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Authors' contributions

MF, CM, MS, KDL, AE and JA initiated and designed the study protocol. WP, DS and JA undertook the data analysis and interpretation. All authors were responsible for reviewing and redrafting the final version of the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from co-author Jon Adams (UTS) on reasonable request.

Consent for publication

Not applicable.

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