



Practitioner characteristics of osteopaths who treat pregnant women and children: An Australasian perspective from two practice-based research networks

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ABSTRACT

Background: Although there is evidence supporting positive outcomes for osteopathic healthcare during pregnancy and post-natal phases, there is very little that describes the practice and management characteristics of osteopaths providing this healthcare. The aim of this study is to describe the specific characteristics of Australian and New Zealand osteopaths who often treat pregnant women and children.

Material and methods: The study is a secondary analysis of data from osteopathy practice-based research networks (PBRN) in Australia and New Zealand. Chi-square tests were used to explore associations between practitioner and practice characteristics among osteopaths who report *often* providing care to children (aged up to 3 years, or between 4 and 18 years) and pregnant women, and those who do not. Backward logistic regression was used to identify significant predictors of Australian osteopaths who report *often* providing care to children (aged up to 3 years, or between 4 and 18 years) and pregnant women.

Results: One third (33.4 %) of surveyed Australian and New Zealand osteopaths (n = 1269) indicated they treat pregnant patients *often*, while 18.3 % indicated they *often* treat children up to 3 years old, and 28.7 % indicated *often* treating children between 4 and 18 years old. Osteopaths who treated pregnant women and children were more likely to be female and to have 15 years or more of clinical experience. Osteopaths who treated pregnant women were more likely to *often* treat patients up three years old, compared to osteopaths who reported *not often* treating pregnant women.

Conclusion: These characteristics suggest osteopaths who provide care to pregnant women are more commonly female, and female osteopaths are more likely to treat children under 3 years old.

1. Introduction

Low-back and pelvic pain [1], and neck pain and headache [2] are common during a pregnancy and can interfere with work, sleep patterns, and daily activities. Non-pharmacological treatments for the management of these conditions is often sought, in part due to concerns that

using analgesic drugs will cause foetal neurodevelopmental toxicity [3], and to assist with preparation for childbirth [4]. Osteopathic healthcare may be one option sought by pregnant women and in the Australian context, approximately 6 % of pregnant women seek out this healthcare [5]. Research suggests clinically relevant benefits for pregnant or postpartum women with low back pain [6–8] with few adverse effects [9].

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Parents also report seeking non-pharmacological treatments including osteopathic healthcare for paediatric conditions such as plagiocephaly and head shape, torticollis, ear, nose, and throat, gastrointestinal, musculoskeletal or respiratory concerns, developmental and cognitive delays [10]. Paediatric patients aged 0–3 account for approximately 16 % of osteopathic consultations in Australia [11,12] and worldwide it is estimated that between 5 and 20 % of the patients treated by osteopaths are children between 0 and 2 years of age [13]. There is emerging, albeit at times conflicting, evidence regarding osteopathic management of paediatric conditions [14–17]. There is favourable evidence for manual therapy for congenital muscular torticollis, plagiocephaly, reduced crying time in infants with colic, and more specifically osteopathic healthcare for breastfeeding support, and reducing recurrence of acute otitis media [17–22].

Osteopaths in Australia [23] and New Zealand [24] are primary contact health professionals, that is, an individual does not require a referral in order to seek care. Pregnant women, and the parents/carers of children, may seek out osteopathy care to address musculoskeletal complaints associated with pregnancy, early stages of life, and adolescence. This care may be in addition to the usual care provided by other health professionals. Although there is evidence supporting positive outcomes for osteopathic healthcare during pregnancy and post-natal phases, there is very little that describes the practice and management characteristics of osteopaths providing this healthcare [4,25]. The aim of this study is to describe the aforementioned characteristics of Australian and New Zealand osteopaths who *often* treat pregnant women and children. The data from this study provides additional evidence of the role that Australian and New Zealand osteopaths play in the treatment of pregnant women and children, and further contributes to the understanding of how best to utilise osteopathy care when managing these populations.

2. Materials and methods

The study is a secondary analysis of data from the Australian and New Zealand osteopathy practice-based research networks (PBRN) [11, 26]. [Redacted for blinded review]

2.1. Participants

Participants for the Australian osteopathy PBRN were recruited through July to December 2016 and for the New Zealand PBRN through August to December 2018. Potential participants were required to be a registered osteopath in the respective country at the time of data collection and were recruited through the countries' respective professional associations by direct email with additional recruitment through social media and snowball sampling to capture osteopaths who were not members of the professional associations [11]. Participants were provided with a randomly generated code that was also used as an identifier for the PBRN. Participants were also reminded that if they had previously completed the survey but received another invitation, they were not required to complete it a second time. Each cohort of osteopaths were invited to complete a workforce survey which performed a dual function: (1) to provide a snapshot of the osteopathy workforce in their respective country and (2) to inform the development of each respective PBRN. Inclusion in the PBRN was optional and not all survey respondents chose to join the PBRN. Consenting participants were invited to complete a self-report questionnaire detailed below.

Responses to the Australian questionnaire were received from 992 osteopaths – a 49.1 % response rate from the 2002 registered Australian osteopaths at the time of data collection. Adams et al. [11] report the respondents to be nationally-representative of the Australian osteopathy profession at the time of data collection. This exceeded the sample size considered necessary for statistical power for this target sample [11,26]. For the New Zealand survey, 277 osteopaths responded. This number represented 48.7 % of registered osteopaths at the time of data collection

[26]. This study pooled and analysed data from the entire sample of survey respondents for both Australia and New Zealand.

2.2. Questionnaire

The questionnaire was developed for the establishment of the PBRNs by a group of experienced health services researchers and osteopaths with research and clinical practice experience. Item wording, content and structure were reviewed by Australiana and New Zealand osteopaths with clinical practice experience, prior to distribution. The questionnaire was available online through Qualtrics. The questionnaire items were largely consistent across Australia and New Zealand (supplementary file 1) except for context specific items such as practice location [26]. The questionnaires utilised items with dichotomous, frequency and Likert-type responses options covering three domains: individual practitioner demographics, practice characteristics and patient management. Practitioner demographics included age, gender, and involvement in professional activities such as university teaching, clinical supervision and volunteering as an osteopath. Practice characteristics explored the number of patients seen per week, and patient care hours per week provided, by the osteopath, referrals to and from other health professionals and approach to diagnosis. The clinical management domain invited participants to indicate the frequency treating different patient populations (e.g., pregnancy, children, sports injuries, workers' compensation), frequency treating different health conditions, and frequency of use of a range of manual therapy techniques.

2.3. Outcome variable and exposure variables

Participants were asked to indicate their frequency of treating pregnant women or children with the response scaled as 'never', 'rarely', 'sometimes', and 'often' for each patient population. Frequency of treating each patient group was treated as the outcome variable and was dichotomised to 'not often' (combining *never* and *rarely*) or 'often' (combining *sometimes* and *often*) in line with other secondary analysis of the Australian data [27–30]. The practitioner and practice characteristics were the exposure variables. Exposure variables with frequency or Likert-type responses were dichotomised for the analysis as for per the description above. All other variables included in the analysis are reported in binary form (yes/no).

2.4. Statistical analyses

Analyses were performed using Stata. Missing data were not imputed. Response rates were calculated based on the number of registered osteopaths in each country at the time of survey distribution. Descriptive statistics were generated for each variable on the questionnaire. Chi-square tests were used to explore association between the outcome variable and dichotomised variables. Alpha was set at $p < 0.05$. Effect sizes were calculated for statistically significant observations with ϕ (w) used for 2x2 calculations and Cramer's V used for larger contingency tables. Effect sizes were interpreted as 0.1 (small), 0.3 (medium) and 0.5 (large). Variables with $p < 0.20$ were entered into a binary logistic regression analysis. Backward elimination was used to determine the important predictors of osteopaths who reported 'often' treating pregnant women and children. Adjusted odds ratios (aOR) with 95 % confidence intervals (CI) and p-values were calculated from this regression modelling. Variables were significantly associated with the outcome variable in the backward regression at $p < 0.05$.

3. Results

Data were analysed from all 1269 survey participants, of whom 424 Australia and New Zealand osteopaths (33.4 %) indicated that they treat pregnant patients *often*. Two-hundred and thirty one osteopaths (18.2 %) indicated they *often* treat children up to the age of 3, and 363 (28.6

%) indicated *often* treating children between the age of 4 and 18. With respect to demographic characteristics, practitioners who reported often treating these patient groups were more likely to be in the 30-40-year age range and female, compared to osteopaths who did *not often* treat these patient groups (Table 1, Supplementary File 2).

Australia and New Zealand osteopaths who reported *often* treating pregnant women, children up to the age of 3 or between the age of 4 and 18, also frequently reported *often* treating other patient groups ($p < 0.01$), compared to colleagues who reported *not often* treating pregnant women (Table 2, Supplementary File 2). With respect to health issues discussed with patients, Australia and New Zealand osteopaths who reported *often* treating pregnant women, or children up to the age of 3 or between the age of 4 and 18, less commonly discussed diet and nutrition ($p < 0.01$), smoking and illicit drug use (*often* pregnant women $p < 0.01$, *often* children age 4–18 $p < 0.01$, not significant for children up to the age of 3), physical activity (only for children under the age of 3 $p = 0.007$), occupational health (for *often* pregnant women $p = 0.001$), stress management ($p < 0.005$ for the three groups), nutritional supplements ($p < 0.001$ for the three groups) and medications ($p < 0.01$ for pregnant women and children age 4–18, not significant for children under the age of 3) compared to osteopaths who *not often* treat these patient groups.

Australia and New Zealand osteopaths who reported *often* treating pregnant women more commonly reported *sometimes* or *often* treating most other musculoskeletal disorders (excluding neck and back pain) compared to osteopaths who reported *not often* treating this patient group (Table 3). With respect to treating children up to 3 years of age, Australia and New Zealand osteopaths who reported *often* treating this

age group were more likely to report *often* treating most upper and lower extremity disorders, headache, migraine, chronic pain, joint disorders and non-muscular disorders compared to osteopaths who reported *not often* treating this patient group (Table 3, Supplementary File 2).

Osteopaths in Australia and New Zealand who reported *often* treating pregnant women more commonly reported using a range of manual therapy interventions ($p < 0.05$) and adjunct interventions including dry needling ($p < 0.01$) and sports taping, compared to osteopaths who reported *not often* treating pregnant women (see Table 4).

The results of the regression analysis are presented in Table 5. Australia and New Zealand osteopaths who treated pregnant women were more likely to identify as female (aOR 1.9, 95%CI[1.4–2.7]) and *often* treat patients up three years old (aOR 4.6, 95%CI[3.3–6.2]), compared to osteopaths who reported *not often* treating pregnant women (see Table 5). Australian and New Zealand osteopaths who reported often treating children up to three years old were also more likely to identify as female (aOR 2.0, 95%CI[1.2–3.4]), compared to osteopaths who report *not often* treating children up three years old. Compared to Australia and New Zealand osteopaths who report *not often* treating pregnant women, osteopaths who treat pregnant women more likely to *often* treat ankle disorders (aOR 1.9, 95%CI[1.4–2.7]), headaches (aOR 3.2, 95%CI[1.6–6.2]), joint disorders (aOR 2.5, 95%CI[1.7–3.7]) and tendinopathies (aOR 1.8, 95%CI[1.3–2.5]). Compared to Australia and New Zealand osteopaths who reported *not often* treating children up to the age of 3, osteopaths who reported often treating this patient group were more likely to *often* treat foot disorders (aOR 1.7, 95%CI[1.1–2.8]), and non-musculoskeletal disorders (aOR 2.7, 95%CI[1.6–4.6]).

Table 1
Participant characteristics.

Characteristics	Patient populations 'often' treated					
	Pregnant women (n = 424)		Children (up to 3 years) (n = 231)		Children (between 4 and 18 years) (n = 363)	
	n (%)	p (Chi ² , ES)	n (%)	P (Chi ² , ES)	n (%)	P (Chi ² , ES)
Age (n = 1266)						
Less than 30 years old	92 (21.8)	<0.001 (19.6, 0.070)	20 (8.7)	<0.001 (43.2, 0.106)	70 (19.3)	0.001 (16.9, 0.067)
Between 30 and 40 years old	184 (43.5)		91 (39.6)		120 (33.2)	
Between 41 and 50 years old	87 (20.6)		67 (29.1)		87 (24.0)	
More than 50 years old	60 (14.2)		52 (22.6)		85 (23.5)	
Country of practice (n = 1269)						
Australia	344 (81.1)	0.08 (3.1)	156 (67.5)	<0.001 (19.2, 0.123)	270 (74.4)	0.04 (4.4, 0.058)
New Zealand	80 (18.9)		75 (32.5)		93 (25.6)	
Years in practice (n = 1252)						
Less than 15 years	296 (70.5)	0.05 (6.1)	118 (51.5)	<0.001 (57.4, 0.151)	210 (58.5)	<0.001 (41.2, 0.128)
Between 15 and 30 years	110 (26.2)		96 (41.9)		124 (34.5)	
More than 30 years	14 (3.3)		15 (6.6)		25 (7.0)	
Patient care hours per week (n = 1252)						
Less than 15 h	69 (16.3)	0.2 (3.6)	34 (14.8)	0.04 (6.3, 0.050)	51 (14.1)	0.09 (4.9)
Between 15 and 30 h	114 (27.0)		83 (36.1)		108 (29.8)	
More than 30 h	240 (56.7)		113 (49.1)		203 (56.1)	
Gender (n = 1269)						
Male	138 (32.6)	<0.001 (28.0, 0.105)	74 (32.0)	0.001 (13.5, 0.073)	156 (43.0)	0.82 (0.4)
Female	286 (67.5)		156 (68.0)		207 (57.0)	
Other	0 (0.0)		0 (0.0)		0 (0.0)	
Qualification (n = 1132)						
Diploma or Advanced diploma	16 (4.1)	0.01 (8.8, 0.062)	16 (8.3)	<0.001 (32.8, 0.120)	16 (5.2)	<0.001 (16.9, 0.086)
Bachelor degree	286 (73.9)		121 (63.0)		200 (64.7)	
Postgraduate degree	85 (22.0)		55 (58.7)		93 (30.1)	

ES – effect size.

Table 2

Frequency Australian and New Zealand osteopaths who report ‘often’ treating pregnant women or children also report treating other patient populations or discussing health topics with their patients.

Characteristics	Patient populations ‘often’ treated								
	Pregnant women (n = 424)			Children (up to 3 years) (n = 231)			Children (between 4 and 18 years) (n = 363)		
	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)
Other populations treated ‘sometimes’ or ‘often’									
<i>Pregnant women (n=1268)</i>	–	–	–	5 (2.2)	226 (97.8)	<0.001 (28.2, 0.149)	15 (4.1)	348 (95.9)	<0.001 (33.7, 0.163)
<i>Children up to 3 years old (n=1262)</i>	141 (33.3)	283 (66.8)	<0.001 (154.0, 0.349)	–	–	–	95 (26.2)	268 (73.8)	<0.001 (207.3, 0.405)
<i>Children between 4 and 18 years old (n=1267)</i>	30 (7.1)	394 (92.9)	<0.001 (44.6, 0.187)	1 (0.4)	230 (99.6)	<0.001 (55.2, 0.208)	–	–	–
<i>Older people (n=1268)</i>	13 (3.1)	411 (96.9)	0.1 (2.6)	12 (5.2)	219 (94.8)	0.5 (0.4)	11 (3.0)	352 (97.0)	0.1 (2.3)
<i>People with sports injuries (n=1267)</i>	17 (4.0)	407 (96.0)	0.05 (4.0)	20 (8.7)	211 (91.3)	0.06 (9.7)	20 (5.5)	342 (94.5)	0.7 (0.2)
<i>First nations people (n=1267)</i>	304 (71.7)	120 (28.3)	0.02 (5.8, 0.067)	145 (62.8)	86 (37.2)	<0.001 (27.0, 0.146)	240 (66.1)	123 (33.9)	<0.001 (26.7, 0.145)
<i>Ethnic or non-English speaking people (n=1265)</i>	313 (73.8)	111 (26.2)	0.001 (10.7, 0.092)	171 (74.4)	59 (25.7)	0.05 (11.0)	262 (72.4)	100 (27.6)	<0.001 (13.6, 0.103)
<i>Post-surgical rehabilitation (n=1266)</i>	150 (35.6)	272 (64.5)	<0.001 (18.2, 0.119)	78 (33.9)	152 (66.1)	0.001 (3.7, 0.054)	109 (30.2)	252 (69.8)	<0.001 (38.0, 0.173)
Topics discussed with patient									
<i>Diet and nutrition (n=1257)</i>	223 (53.0)	198 (47.0)	<0.001 (18.2, 0.120)	116 (50.2)	115 (49.8)	<0.001 (13.7, 0.104)	184 (50.8)	178 (49.2)	<0.001 (22.7, 0.134)
<i>Smoking and drug use (n=1223)</i>	322 (77.6)	93 (22.4)	0.002 (10.0, 0.090)	183 (80.6)	44 (19.4)	0.5 (0.6)	268 (75.1)	89 (24.9)	<0.001 (18.3, 0.122)
<i>Physical activity (n=1267)</i>	43 (10.1)	381 (89.9)	0.3 (1.1)	38 (16.5)	193 (83.6)	0.007 (7.3, 0.075)	40 (11.0)	323 (89.0)	0.8 (0.1)
<i>Occupational health (n=1244)</i>	182 (43.5)	236 (56.5)	0.001 (11.3, 0.095)	119 (53.1)	105 (46.9)	0.3 (1.0)	172 (48.6)	182 (51.4)	0.5 (0.5)
<i>Pain management (n=1201)</i>	287 (70.5)	120 (29.5)	0.1 (2.4)	158 (72.8)	59 (27.2)	0.9 (0.03)	235 (68.5)	108 (31.5)	0.02 (5.7, 0.068)
<i>Stress management (n=1258)</i>	155 (36.8)	266 (63.2)	<0.001 (38.9, 0.175)	90 (39.7)	137 (60.4)	0.002 (10.0)	153 (42.5)	207 (57.5)	0.002 (9.4, 0.086)
<i>Nutritional supplements (n=1206)</i>	275 (66.9)	136 (33.1)	<0.001 (12.2, 0.100)	145 (63.9)	82 (36.1)	<0.001 (12.2, 0.100)	235 (66.6)	118 (33.4)	0.001 (11.4, 0.097)
<i>Medications (n=1249)</i>	227 (53.9)	194 (46.1)	<0.001 (12.3, 0.099)	148 (64.9)	80 (35.1)	0.2 (1.9)	193 (53.8)	166 (46.2)	0.001 (10.4, 0.091)

^a Frequency of characteristics i.e., other populations treated, topics discussed with patient.

4. Discussion

This secondary analysis of data from the Australian and New Zealand osteopathy practice-based research networks identified that, across the two countries, approximately one-third of osteopaths *often* treat pregnant women, just under one-third *often* treat children between four and eighteen years old, while one-fifth will *often* treat children up to three years old. These outcomes suggest management of these patient groups forms a significant component of Australia and New Zealand osteopathic practice.

4.1. Populations consulting with osteopaths

The findings from the current study broadly align with data from other countries exploring patient presentations to osteopaths. In Spain, for example, 15 % of osteopaths have a special interest in pregnancy

[31], and in Quebec (Canada), 44 % of osteopaths report that their practice includes perinatal care, while 2.4 % of consultations are specifically for pregnant women suffering from pain or discomfort [10]. There is similar variability in the proportion of osteopaths who report treating paediatric populations: 10–14 % of the patients in Switzerland are under two years old [32,33]; 20 % of osteopaths in Spain see patients under two years old [31] and 10 % of patients in Quebec Canada are under the age of 15 [10]. While the reason behind this variability between countries is not known, there may be factors within those countries driving patients to access osteopathic healthcare for these populations. Professional experience and reputation are both important element that favour referrals by physicians to an osteopath for paediatric populations [34] and a parent’s choice of manual therapist for their child’s care [35]. Worldwide, it appears that osteopaths are playing a significant role in the care of pregnant women, and child and adolescent populations [13].

Table 3

Frequency Australian and New Zealand osteopaths who report 'often' treating pregnant women or children also report treating specific health conditions.

Conditions treated	Patient populations 'often' treated								
	Pregnant women (n = 424)			Children (up to 3 years) (n = 231)			Children (between 4 and 18 years) (n = 363)		
	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	<i>P</i> (<i>Chi</i> ² , <i>ES</i>)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	<i>P</i> (<i>Chi</i> ² , <i>ES</i>)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	<i>P</i> (<i>Chi</i> ² , <i>ES</i>)
Neck pain (n=1268)	4 (0.9)	420 (99.1)	0.1 (2.4)	7 (3.0)	224 (97.0)	0.2 (1.6)	9 (2.5)	354 (97.5)	0.4 (0.7)
Thoracic pain (n=1268)	22 (5.2)	402 (94.8)	0.003 (9.0, 0.084)	22 (9.5)	209 (90.5)	0.7 (0.1)	29 (8.0)	334 (92.0)	0.5 (0.6)
Back pain (n=1265)	3 (0.7)	421 (99.3)	0.2 (2.0)	7 (3.0)	224 (97.0)	0.02 (5.1, 0.063)	7 (1.9)	356 (98.1)	0.3 (0.9)
Hip disorders (n=1264)	69 (16.3)	354 (83.7)	<0.001 (31.4, 0.157)	50 (21.7)	181 (78.4)	0.07 (3.2)	60 (16.5)	3030 (83.5)	<0.001 (25.1, 0.141)
Knee disorders (n=1262)	160 (37.7)	264 (62.3)	<0.001 (39.0, 0.175)	92 (39.8)	139 (60.2)	<0.001 (12.4, 0.099)	120 (33.2)	242 (66.9)	<0.001 (59.3, 0.216)
Ankle disorders (n=1261)	213 (50.4)	210 (49.7)	<0.001 (64.3, 0.225)	117 (50.7)	114 (49.4)	<0.001 (26.9, 0.146)	162 (44.8)	200 (55.3)	<0.001 (95.4, 0.275)
Foot disorders (n=1262)	243 (57.3)	181 (42.7)	<0.001 (54.3, 0.207)	124 (53.7)	107 (46.3)	<0.001 (54.3, 0.175)	187 (51.7)	175 (48.3)	<0.001 (87.3, 0.263)
Shoulder disorders (n=1264)	54 (12.7)	370 (87.3)	<0.001 (14.7, 0.107)	48 (20.8)	183 (79.2)	0.4 (0.6)	46 (12.7)	316 (87.3)	<0.001 (12.6, 0.099)
Elbow disorders (n=1252)	252 (59.9)	169 (40.1)	<0.001 (76.1, 0.246)	146 (63.2)	85 (36.8)	<0.001 (20.9, 0.129)	215 (59.9)	144 (40.1)	<0.001 (60.4, 0.219)
Wrist disorders (n=1256)	289 (68.2)	135 (31.8)	<0.001 (68.9, 0.234)	158 (68.7)	72 (31.3)	<0.001 (28.3, 0.150)	251 (69.7)	109 (30.3)	<0.001 (42.7, 0.184)
Hand disorders (n=1223)	324 (77.5)	94 (22.5)	<0.001 (54.5, 0.211)	174 (76.3)	54 (23.7)	<0.001 (31.5, 0.160)	271 (76.8)	82 (23.2)	<0.001 (49.8, 0.201)
Postural disorders (n=1262)	106 (25.1)	317 (74.9)	<0.001 (26.9, 0.145)	79 (34.2)	152 (65.8)	0.8 (0.1)	103 (28.6)	257 (71.4)	0.002 (9.3, 0.085)
Spinal conditions (n=1262)	149 (35.1)	275 (34.9)	<0.001 (12.3, 0.098)	97 (42.0)	134 (58.0)	<0.01 (10.0, 0.089)	127 (35.1)	235 (64.9)	0.001 (10.6, 0.091)
Headache (n=1266)	17 (4.0)	407 (96.0)	<0.001 (30.2, 0.154)	12 (5.2)	219 (94.8)	0.002 (9.2, 0.085)	27 (7.5)	335 (92.5)	0.01 (6.2, 0.069)
Migraine (n=1263)	191 (45.1)	233 (54.9)	<0.001 (56.3, 0.211)	108 (46.8)	123 (53.3)	<0.001 (20.0, 0.125)	162 (44.9)	199 (55.1)	<0.001 (46.8, 0.192)
Spinal health (n=1245)	173 (41.1)	248 (58.9)	<0.001 (36.0, 0.170)	98 (43.0)	130 (57.0)	0.001 (11.2, 0.094)	153 (43.0)	203 (57.0)	<0.001 (19.9, 0.126)
Chronic pain (n=1264)	123 (29.0)	301 (71.0)	<0.001 (27.5, 0.147)	72 (31.2)	159 (68.8)	0.007 (7.4, 0.076)	111 (30.6)	252 (69.4)	<0.001 (15.7, 0.111)
Tendinopathies (n=1256)	204 (48.2)	219 (51.8)	<0.001 (41.4, 0.181)	140 (61.4)	88 (38.6)	0.8 (0.1)	174 (48.5)	185 (51.5)	<0.001 (31.9, 0.159)
Temporomandibular joint disorders (n=1251)	288 (68.1)	135 (31.9)	<0.001 (91.6, 0.270)	154 (67.0)	76 (33.0)	<0.001 (46.4, 0.192)	260 (72.4)	99 (27.6)	<0.001 (35.1, 0.167)
Non-muscular disorders (n=938)	240 (71.4)	96 (28.6)	<0.001 (38.6, 0.202)	123 (58.6)	87 (41.4)	<0.001 (99.7, 0.326)	201 (66.8)	100 (33.2)	<0.001 (67.9, 0.326)

^a Frequency of treating each condition; ES – effect size.

4.2. Influence of practitioner characteristics

Australian and New Zealand osteopaths who reported *often* treating pregnant women and children up to three years old were more than twice as likely to be female compared to osteopaths who indicated treating this patient population on a *not often* basis. The influence of gender on the likelihood of osteopaths providing care to pregnant and paediatric populations is unclear and requires further study, but may be explained by social, professional, and personal factors [11]. posited that

non-biomedical systems of medicine may reflect a feminist model of care through core tenets such as holism, women's empowerment, and the democratization of knowledge. Furthermore, Sheraton et al. [4] suggest that women accessing osteopathic healthcare may experience osteopathy in this way and that this experience may be amplified if the care is provided by a female osteopath. It is driven by patient preference for female healthcare professionals, by female osteopaths who have a particular interest in maternal and child health, by male osteopaths being less interested in providing care to these populations and referring

Table 4

Frequency Australian and New Zealand osteopaths who report 'often' treating pregnant women or children also report using specific treatments, therapies or techniques with their patients.

Treatments used	Pregnant women (n = 424)			Children (up to 3 years) (n = 231)			Children (between 4 and 18 years) (n = 363)		
	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)	Never/ Rarely ^a [n (%)]	Sometimes/ Often ^a [n (%)]	P (Chi ² , ES)
<i>Strain/Counterstrain</i> (n=1149)	201 (50.4)	198 (49.6)	<0.001 (12.8, 0.105)	113 (56.2)	88 (43.8)	0.7 (0.2)	167 (51.7)	156 (48.3)	0.01 (6.1, 0.072)
<i>Muscle energy techniques</i> (n=1242)	83 (20.1)	330 (79.9)	0.08 (3.1)	87 (39.9)	131 (60.1)	<0.001 (42.3, 0.184)	102 (29.4)	245 (70.6)	0.001 (10.6, 0.092)
<i>High velocity low amplitude/spinal manipulation</i> (n=1201)	130 (32.9)	265 (67.1)	0.8 (0.1)	100 (50.3)	99 (49.8)	<0.001 (30.1, 0.155)	118 (35.5)	214 (64.5)	0.3 (1.0)
<i>Peripheral joint manipulation</i> (n=1213)	204 (51.3)	194 (48.7)	0.04 (4.2)	115 (56.1)	90 (43.9)	0.8 (0.1)	163 (48.7)	172 (51.3)	0.004 (8.1, 0.081)
<i>Soft tissue techniques</i> (n=1250)	65 (15.7)	350 (84.3)	0.04 (4.3, 0.018)	61 (27.5)	161 (72.5)	<0.001 (49.8,0.199)	69 (19.6)	284 (80.5)	<0.001 (18.9, 0.122)
<i>Myofascial release</i> (n=1219)	117 (28.3)	297 (71.7)	<0.001 (16.7, 0.117)	72 (32.6)	149 (67.4)	0.2 (1.5)	117 (33.5)	232 (66.5)	0.2 (1.5)
<i>Cranial techniques</i> (n=913)	172 (49.6)	175 (50.4)	<0.001 (21.6, 0.153)	45 (19.8)	182 (80.2)	<0.001 (194.1, 0.461)	122 (40.3)	181 (59.7)	<0.001 (68.0, 0.273)
<i>Facilitated positional release</i> (n=984)	252 (70.2)	107 (29.8)	0.001 (11.5, 0.108)	125 (64.8)	68 (35.2)	<0.001 (17.3, 0.132)	207 (70.2)	88 (29.8)	0.004 (8.4)
<i>Needling techniques</i> (n=472)	61 (36.3)	107 (63.7)	<0.001 (12.8)	17 (40.5)	25 (59.5)	0.4 (0.8)	46 (39.7)	70 (60.3)	0.05 (3.8, 0.092)
<i>Visceral techniques</i> (n=1025)	298 (78.8)	80 (21.2)	<0.001 (12.9, 0.112)	151 (69.9)	65 (30.1)	<0.001 (40.6, 0.199)	240 (76.0)	76 (24.0)	<0.001 (22.5, 0.148)
<i>Lymphatic pump</i> (n=1049)	306 (83.2)	62 (16.9)	<0.001 (24.8, 0.153)	162 (78.3)	45 (21.7)	<0.001 (35.2, 0.183)	253 (81.4)	58 (18.6)	<0.001 (31.2, 0.172)
<i>Autonomic balancing</i> (n=751)	181 (64.0)	102 (36.0)	<0.001 (14.3, 0.137)	95 (49.7)	96 (50.3)	<0.001 (60.9, 0.284)	141 (57.6)	104 (42.4)	<0.001 (36.1, 0.219)
<i>Biodynamic techniques</i> (n=545)	117 (51.3)	111 (48.7)	<0.001 (20.5, 0.193)	57 (34.1)	110 (65.9)	<0.001 (81.5, 0.386)	91 (45.8)	108 (54.3)	<0.001 (37.1, 0.260)
<i>Functional techniques</i> (n=1119)	199 (51.4)	188 (48.6)	<0.001 (47.6, 0.206)	98 (44.0)	125 (56.0)	<0.001 (52.4, 0.216)	170 (51.4)	161 (48.6)	<0.001 (37.4, 0.182)
<i>Balanced ligamentous tension/Ligamentous articular strain</i> (n=1095)	158 (41.2)	226 (58.9)	<0.001 (52.3, 0.218)	66 (29.3)	159 (70.7)	<0.001 (81.3, 0.272)	133 (40.4)	196 (59.6)	<0.001 (46.3, 0.205)
<i>Exercise prescription or advice</i> (n=1262)	96 (22.8)	325 (77.2)	0.3 (1.3)	82 (35.5)	149 (64.5)	<0.001 (17.5, 0.117)	91 (25.2)	270 (74.8)	0.8 (0.1)
<i>Chapmans reflexes</i> (n=384)	130 (88.4)	17 (11.6)	0.1 (2.6)	76 (84.4)	14 (15.6)	0.01 (6.3, 0.128)	111 (86.7)	17 (13.3)	0.03 (4.6, 0.109)
<i>Trigger point therapy</i> (n=1004)	208 (61.5)	130 (38.5)	0.04 (0.1, 0.009)	117 (70.9)	48 (29.1)	0.2 (2.0)	175 (61.6)	109 (38.4)	0.06 (3.7)
<i>Sports taping</i> (n=994)	256 (80.3)	63 (19.8)	0.02 (0.3, 0.017)	125 (89.3)	15 (10.7)	0.07 (3.2)	200 (77.5)	58 (22.5)	0.001 (11.8, 0.108)

^a Frequency of using treatment technique.

patients to their female colleagues [36–38], or by other reasons entirely.

4.3. Osteopathic care during pregnancy and post-partum

The present study highlights several key characteristics of osteopaths that report *often* treating pregnant women or children. Australian and New Zealand osteopaths who reported *often* treating pregnant women were over four times more likely to also report *often* treating children under the age of three years compared to osteopaths who indicated *not often* treating pregnant women. It is also possible that this relationship suggests osteopaths provide continuation of care through the pregnancy

and care of the newborn into infant stages [4]. Such continuity may suggest a therapeutic relationship and experiences of care that engender the patient to hold a positive regard for the osteopath, thereby encouraging the woman to continue consulting the osteopath for their child's care [35]. This possibility is supported by previous qualitative work investigating the experiences of pregnant woman receiving osteopathic healthcare [4]. These authors identified several participants who reported they had also received, or intended to access, osteopathic healthcare for their babies post-partum. This is also consistent with another qualitative piece, in which osteopaths who treat patients under 2 years of age report that they involve the osteopathic healthcare family

Table 5

Outcome of backwards stepwise logistic regression (excludes variables with <70 % response rate from total sample).

Characteristic	Often treat pregnant women		Often treat children (up to 3 years old)		Often treat children (between 4 and 18 years old)	
	Odds ratio (95 % CI ^a)	p	Odds ratio (95 % CI ^a)	p	Odds ratio (95 % CI ^a)	p
Age						
<i>Less than 30 years old</i>	Ref ^b		Ref ^b		–	–
<i>Between 30 and 40 years old</i>	1.3 (0.9–1.8)	0.2	2.2 (1.2–4.1)	0.02	–	–
<i>Between 41 and 50 years old</i>	0.9 (0.6–1.4)	0.6	0.8 (0.4–1.9)	0.7	–	–
<i>More than 50 years old</i>	0.4 (0.2–0.8)	0.007	0.4 (0.1–1.0)	0.05	–	–
Gender						
<i>Male</i>	Ref ^b		Ref ^b		–	–
<i>Female</i>	1.9 (1.4–2.7)	<0.001	2.0 (1.2–3.4)	0.006	–	–
Years in practice						
<i>Less than 15 years</i>	–	–	Ref ^b		–	–
<i>Between 15 and 30 years</i>	–	–	3.4 (1.7–6.9)	0.001	–	–
<i>More than 30 years</i>	–	–	4.1 (0.8–22.5)	0.1	–	–
Qualification						
<i>Diploma or Advanced diploma</i>	Ref ^b		Ref ^b		–	–
<i>Bachelor degree</i>	0.3 (0.1–0.9)	0.03	0.6 (0.2–2.0)	0.4	–	–
<i>Postgraduate degree</i>	0.2 (0.1–0.5)	0.001	0.3 (0.1–0.8)	0.01	–	–
Populations treated						
<i>Children up to 3 years old</i>	4.6 (3.3–6.2)	<0.001	–	–	6.8 (4.5–10.3)	<0.001
<i>Pregnant women</i>	–	–	8.5 (2.5–28.3)	0.001	2.3 (1.5–3.5)	<0.001
Topics discussed with patients						
<i>Medications</i>	1.5 (1.1–2.0)	0.007	–	–	–	–
Conditions treated						
<i>Ankle disorders</i>	1.9 (1.4–2.7)	<0.001	–	–	–	–
<i>Foot disorders</i>	–	–	1.7 (1.1–2.8)	0.03	–	–
<i>Headache</i>	3.2 (1.6–6.2)	0.001	–	–	–	–
<i>Joint disorders</i>	2.5 (1.7–3.7)	<0.001	–	–	–	–
<i>Tendinopathies</i>	1.8 (1.3–2.5)	<0.001	–	–	1.7 (1.2–2.6)	0.007
<i>Non-musculoskeletal disorders</i>	–	–	2.7 (1.6–4.6)	<0.001	2.7 (1.6–4.4)	<0.001
Treatments used						
<i>Muscle energy techniques</i>	–	–	0.5 (0.3–0.8)	0.009	–	–
<i>Cranial techniques</i>	–	–	6.8 (4.2–11.1)	<0.001	–	–
<i>Sports taping</i>	–	–	–	–	2.7 (1.6–4.6)	<0.001

^a 95 % Confidence interval.^b Reference category.

in the consultation, and sometimes treating both parents and children [39]. Further research could explore the osteopathic healthcare 'journey' through pregnancy into neonate and infant care.

4.4. Conditions treated by osteopaths during pregnancy and post-partum

Headaches and temporomandibular joint disorders were more than twice as likely to be managed by Australian and New Zealand osteopaths who reported *often* treating pregnant women compared to osteopaths who *not often* treat this patient population. This may be due to pregnant women looking for non-pharmacological options due to medication hesitancy during pregnancy and lactation periods [34,35,40]. Another possible reason is the increasing prevalence of these conditions during pregnancy: headache is reported to be 10%–17 % and temporomandibular symptoms can be as high as 72 % [41,42]. There is literature supporting the use of manual therapy, including osteopathy, for the management of headache disorders [43–48] and of temporomandibular joint pain and dysfunction [41,49,50]. Whether pregnant women specifically seek out osteopathy healthcare for headaches and/or

temporomandibular joint disorders during their pregnancy requires additional investigation. Australian and New Zealand osteopaths who reported *often* treating pregnant women were also more likely to report *often* treating tendinopathies compared to colleagues who reported *not often* treating pregnant women. This is consistent with the prevalence of tendinopathies, particularly affecting the hip, increasing over the course of a pregnancy [51,52]. There is limited literature on the management of tendinopathies by osteopaths [53,54] and none that specifically addresses this musculoskeletal issue during pregnancy. This gap presents an opportunity to explore how tendinopathies are managed by osteopaths, in addition to the safety and effectiveness outcomes of this care.

4.5. Limitations

The results of this study are limited by the self-report nature of the data and the possibility of social and acquiescence biases in the responses. The dichotomisation of the data potentially reduces the nuance in the interpretation. Additionally, respondents were not guided as to what constituted never/rarely/sometimes/often on the questionnaire

Likert-type scale. This may create scenarios where there is individual variability in item response based on these frequencies. However, this exploratory work has identified several avenues for future work focusing on the patient experience of osteopathic healthcare throughout a pregnancy or during childhood, the manual therapy and adjunct interventions used specifically in managing pregnant women, and the potential care continuum from pregnancy and through to the newborn and infant.

5. Conclusion

This is the first study to describe the characteristics of Australian and New Zealand osteopaths who report often treating pregnant women, children and adolescents. This secondary analysis of data from the Australian and New Zealand osteopathy practice-based research networks has highlighted a number of practitioner characteristics associated with frequently treating pregnant women and children. These characteristics suggest that it is female osteopaths who are more likely to manage pregnant women, and they are more likely to treat children under the age of three. The latter finding may be associated with continued care from pregnancy to the newborn however, this assertion requires further investigation. The results underline that osteopathic healthcare for paediatric populations are more frequently offered by experienced practitioners. The study adds to the developing literature on the management of pregnancy and childhood-related complaints by osteopaths and provides an insight to guide future research and multi-disciplinary care for pregnant women and children.

CRedit authorship contribution statement

Amie Steel: Writing – review & editing, Writing – original draft, Conceptualization. **Jerry Draper-Rodi:** Writing – review & editing, Writing – original draft. **Michael Fleischmann:** Writing – review & editing, Writing – original draft. **Chantal Morin:** Writing – review & editing, Writing – original draft. **Ana Paula A. Ferreira:** Writing – review & editing, Writing – original draft. **Brett Vaughan:** Writing – review & editing, Writing – original draft. **Paul Orrock:** Writing – review & editing, Writing – original draft, Conceptualization.

Consent to participate

As this study employed secondary analysis of an existing dataset, no consent to participate was sought.

Ethics approval

Ethics approval was granted by the University of Technology, Sydney Human Research Ethics Committee (Australian PBRN: # 2014000759; New Zealand PBRN: #ETH19-3435)

Consent for publication

Not applicable.

Availability of data and material

Data is available upon reasonable request by contacting sph_pbrn@uts.edu.au [Redacted for blinded review]

Authors' contributions

Conceptualisation: AS, PO; Data curation: AS; Formal analysis: AS; Methodology: AS; Project administration: AS; Supervision: AS; Validation: AS; Writing: AS, JD-R, MF, CM, AP-F, PO. [Redacted for blinded review]

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Conflicts of interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctcp.2024.101929>.

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