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Original Article

Work-related musculoskeletal injuries among Australian osteopaths: A preliminary investigation

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ABSTRACT

Background: Work-related musculoskeletal injury (WRMI) is a significant risk factor for registered manual therapists, including physiotherapists, occupational therapists and chiropractors. The physically demanding nature of manual therapy has been identified as the common factor in WRMIs among these professions. There is currently no available literature on the prevalence of WRMIs among osteopaths.
Objective: This research sought to collect preliminary data to establish the prevalence and characteristics of WRMIs among Australian osteopaths; including body area injured, risk factors and strategies used to manage injury.
Method: Registered osteopaths, who were members of the professional association Osteopathy Australia, were invited to participate via an online survey.
Results: A total of 160 surveys were completed. The incidence of WRMI was high, with 58% of respondents having sustained one or more injuries. Results indicated that the wrist and the fingers are the most frequently injured areas (41%), while the least injured body part was the knee (1.1%). Performing repetitive tasks accounted for 52% of injuries, followed by performing manipulative techniques (23%). Working too many hours per week (43%) and fatigue (38%) were the main factors contributing to injury.
Conclusions: The findings highlight the risk to osteopaths of sustaining musculoskeletal injuries while working in clinical practice.

Introduction

Work-related musculoskeletal injuries (WRMIs) are reported to have a high incidence in registered health practitioners who engage in manual therapy [1–8]. Manual therapy refers to joint mobilisation and manipulation, passive range of motion, stretching and soft tissue techniques [3]. Although research concerning WRMIs in osteopaths is lacking, research from similar manual therapy professions—for example, chiropractic, occupational therapy (OT), and physiotherapy/physical therapy (PT)—suggests WRMIs are a growing problem that significantly affect the health and work situation of therapists who perform physical therapy as part of patient care. For these therapists, the deleterious consequences of injury at work can include taking time off work, modifying work habits, changing the work setting or leaving the profession altogether [1,7,8]. These consequences can cause considerable financial and personal burdens for practitioners, which may affect future retention rates within the health professions.

The term WRMI encompasses a range of injurious effects to soft tissues (muscles, tendons and ligaments) and intra- and extra-articular elements as well as the psychological well-being of therapists who sustain these injuries. Pain, movement problems and depression are just a few of the symptoms experienced by workers affected by musculoskeletal injuries [9]. The physically demanding nature of manual therapy contributes to WRMIs in therapists and is associated with a variety of risk factors [3,7,10]. Factors predisposing therapists to injury include faulty mechanical loading to joints; unbalanced posture; repetitive strain and aggravation of previous injury [2,10]. Common therapeutic tasks associated with these predisposing factors involve (a) manual therapy that includes soft tissue work, joint mobilisation (including manipulation) and passive range of motion [1–3,11] and (b) patient handling, including repositioning and lifting patients. Continuous bending, unexpected abrupt movements by the patient, limited working space, age and gender have also been identified as risk factors [8,12]. The literature

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shows the reported lifetime prevalence of WRMIs for PTs as 55% in Australia, 68% in the United Kingdom, 85% in Turkey and 32% in the United States, with the low back the most commonly injured body area followed by hand and wrist, neck, shoulder and upper back [1,6,8,11–14]. For chiropractors working in the United States the prevalence of WRMIs has been reported as 40.1% [2].

Findings from a number of studies draw attention to the different approaches to patient care used in the manual therapy professions and the consequent differences in injuries sustained by practitioners. Campo et al. [11] undertook a prospective study to determine the 1-year incidence and prevalence rates of WRMIs in PTs in the United States. Of the 507 PTs studied, 57.5% reported a work-related injury with injuries to the low back most common, followed by the wrist and hand and the neck and shoulder. Activities that contributed to low back injury for the PT's involved assisting patients with mobility limitations—for example, transferring a patient from a bed to a wheelchair [11]. In contrast, a nationwide study of chiropractors in the United States undertaken by Holm and Rose [2] found fingers and wrists to be the most frequently reported area of injury followed by shoulder and low back. More recent research by Homach & Hedge [15] investigating WRMI in chiropractors working in New York State found that the very physically demanding nature of performing spinal manipulation was a risk factor for both low back pain and upper extremity injury.

Two studies of Australian PTs by Snodgrass et al. [10] and Wajon and Ada [16] revealed that therapists who perform manipulative therapy, especially spinal manipulation and the use of thumb pressure in joint glide manoeuvres had a higher incidence of WRMI related to hand and wrist pain, especially thumb pain. Wajon and Ada [16] found that of 192 PTs, 83% reported thumb pain from performing spinal manipulative therapy. Similar findings have been reported in the chiropractic profession [2,15].

There is currently no literature on the prevalence of WRMIs in Australian osteopaths. While osteopaths perform similar tasks to other healthcare manual therapists, it cannot be assumed that the WRMI trends in the existing data from other professions can be extrapolated to osteopaths. The purpose of this research was to determine the prevalence and characteristics of WRMI among Australian osteopaths.

Method

Design

An online cross-sectional survey, administered by Google Analytic Solutions [17], was used to investigate the prevalence of WRMIs in Australian osteopaths. The questionnaire design was based on previous questionnaires from work related injury studies [7,8] and comprised 20 items designed to capture demographic, work and injury related information (See appendix 1).

Participants

Registered osteopaths who were members of the osteopathic professional association Osteopathy Australia (OA) were invited to participate in this research. All OA members ($N = 1800$) received an email that contained a hyperlink to the online survey as well as information pertaining to the research, including the participant consent processes. Osteopathy Australia was the selected recruitment body as its membership comprises over 90% of Australian osteopaths [18]. To maximise response rate, an announcement of the research was also placed in the OA news bulletin distributed via email.

Data collection

The survey data was gathered over a two-week period in late August and early September 2015. Injury incidence was elicited with the question “Have you ever sustained a work-related injury from working as an osteopath?” If respondents indicated they had acquired a work-related injury, the survey then directed them to questions to uncover further information about their injury, work procedures and work setting. Participants who had sustained more than one injury were asked to provide details of the most serious injury. They were then asked to provide information about that particular injury: location, type, suspected cause, contributing factors, management of and effects on work practices. The time required to complete the survey was approximately 15 min.

Although the survey responses were anonymous, respondents who had sustained a work related injury were offered the opportunity to provide their email address if they wished to provide detailed contextual information about their injury at interview. A number of respondents indicated their willingness to be interviewed, and the results from the analysis of these interviews is reported separately [19].

Data analysis

All data were collated using an Excel spreadsheet (Microsoft Office Professional Plus 2013) and analysed using IBM SPSS Statistics V22. Responses were tabulated question by question. Nominal data was tallied and described as frequency and percentage, and continuous data was summarised as median (interquartile range). The characteristics of respondents who did and did not report having a work-related injury and who had and had not been exposed to training in work-related injury prevention were compared using the Chi-square or Fisher's exact test, as appropriate for categorical responses, and the Mann–Whitney U test for years in clinical practice. Associations between age group, hours worked per week, years in clinical practice and number of injuries were explored using Spearman's correlations.

Results

Participant demographics and background

One hundred and sixty (160) registered osteopaths completed the online survey giving a response rate of 9%. Missing data were identified for two items. One item, *body area injured*, was pair-wise deleted in three instances. The subset sample for this variable after pair-wise deletion was therefore n = 90. Another item, *years in clinical practice*, was modified in a single case by imputation of the mean calculated from all entries from the age group relevant to the respondent.

Of the total respondents, 61% were female ($n = 98$). The majority of respondents (68%) were under 41 years of age and the age range was 25–71 years. The number of years in clinical practice ranged from less than one to more than 50, with 78% ($n = 125$) of respondents having been in practice for 15 or less years. A summary of the basic demographic information of the respondents is shown in Table 1.

The number of hours worked in clinical practice (direct patient care), during a single week ranged from less than 15 to more than 50. Forty-four percent ($n = 71$) of the respondents worked between 30 and 50 h per week. Only 4% of the respondents worked more than 50 h per week. (Fig. 1 provides a breakdown of hours worked per week).

Table 1
Demographic data (n = 160).

	n	%
Gender		
Male	62	38.7
Female	98	61.3
Age (years)		
Under 26	12	7.5
26–30	35	21.9
31–40	62	38.8
41–50	37	23.1
51+	14	8.8
Hours worked per week		
<15	22	13.7
15–30	60	37.5
30–50	71	44.4
>50	7	4.4
Work setting		
Associate	44	27.5
Group practice/self employed	61	38.1
Sole practitioner	55	34.4
Years in clinical practice[a]		
<5	47	29.4
5-10	50	31.3
10-15	28	17.5
15-20	14	8.7
20-25	7	4.4
>25[b]	14	8.7
Injury prevention included in osteopathic education		
Yes	104	65.0
No	56	35.0

[a] Reported categorically to describe frequency distribution.
[b] >25 range = 26–51 years (two outliers with 40 & 51 years).

Prevalence of WRMIs

Of the 93 respondents who reported a WRMI (Table 2), more than half were female 60% (56 females and 37 males), with 56% of those injuries sustained within the first five years of clinical practice (Fig. 3). There was a tendency for repeated injury in those with more years in clinical practice, in those working fewer hours per week and in those employed in a group practice, although differences between groups were not statistically significant. The prevalence of injury according to respondent characteristics is summarised in Table 2.

Note that in Table 2, the *number of years in practice* is reported as the median. The presence of outliers posed a risk of bias to estimates; therefore, the median was used to enable comparison of the presence of WRMI and no WRMI, with years in practice.

Number of injuries sustained by individual respondents

While a third (34%) of the respondents who had sustained a WRMI reported having a single injury, the majority (66%) reported having sustained more than one injury. The number of injuries sustained by those reporting injury is shown in Fig. 2.

The number of injuries reported was not found to be related to age ($r = 0.076$, $p = 0.517$), years in clinical practice ($r = 0.052$, $p = 0.662$) or hours worked per week ($r = 0.076$, $p = 0.519$). There were also no differences between males and females ($p = 0.862$) or between work setting ($p = 0.832$). Fifty-six percent ($n = 52$) of respondents reported having been injured early in their career (less than five years), with 29% ($n = 27$) of those injuries occurring within the first two years (see Fig. 3).

Body area and type of injury

The most frequently injured anatomical body area was fingers and wrists (41%), while the least frequently injured body area was the knee (1.1%). Injury prevalence (single most serious) by anatomical body area as reported by respondents (n = 90) is shown in Fig. 4.

In addition to body area injured, the survey also asked respondents to select from a range of injury types: sprains involving ligaments, strains involving muscles and tendons, neuropathies, tendinopathies, fractures, and 'other'. The most common injury types were sprains, strains and tendinopathies in almost equal rates of incidence. Injury types listed as 'other' by a small number of participants were dislocations, compression and degeneration. Fig. 5 shows the percentage of respondents by type of injury reported.

Participants were also asked to indicate the activity they believed had caused their injury. By far the most common (53%) was performing repetitive tasks, such as soft tissue techniques involving inhibition or friction massage. This was followed by performing a manipulative technique (23%). A small percentage of

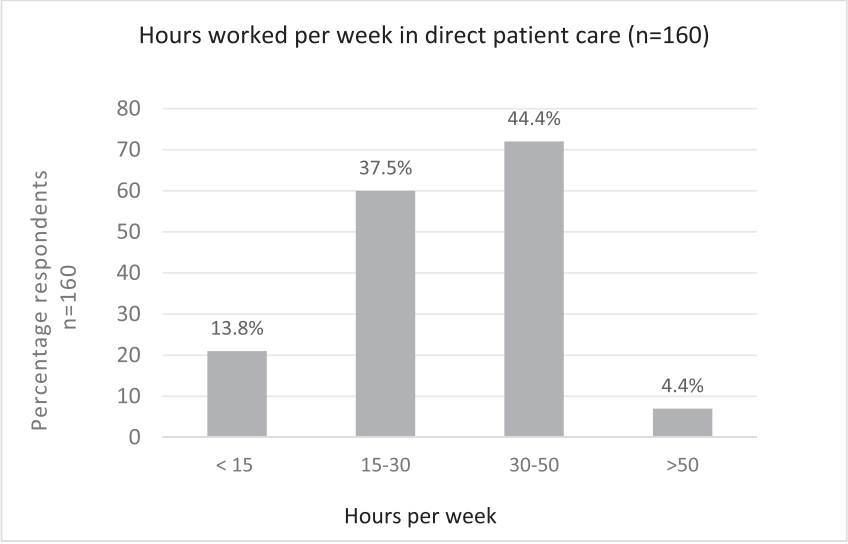

Fig. 1. Hours work per week in direct patient care.

Table 2
Work-related injury by respondent characteristics ($N = 160$).

	WRMI (n = 93)		No WRMI (n = 67)		*Odds ratio (95% CI)*	*p*-value
Gender	*n*	%	*n*	%		0.752
Male	37	59.7	25	40.3	1	
Female	56	57.1	42	42.9	0.9 (0.5–1.7)	
Age (years)	*n*	%	*n*	%		0.739
Under 26	7	58.3	5	41.7	1	
26–30	18	51.4	17	48.6	0.8 (0.2–2.8)	
31–40	35	56.5	27	43.5	0.9 (0.3–3.2)	
41–50	23	62.2	14	37.8	1.2 (0.3–4.4)	
51+	10	71.4	4	28.6	1.8 (0.3–9.1)	
*Years in clinical practice, median (IQR)[a]	10 (5–15)		9 (3.5–14)			0.130
Hours worked per week	*n*	%	*n*	%		0.480
<15	16	72.7	6	27.3	1	
15–30	35	58.3	25	41.7	0.5 (0.2–1.5)	
30–50	38	53.5	33	46.5	0.4 (0.2–1.2)	
>50	4	57.1	3	42.9	0.5 (0.1–2.9)	
Work setting	*n*	%	*n*	%		0.198
Associate	28	63.6	16	36.4	1	
Group practice/ self employed	30	49.2	31	50.8	0.6 (0.3–1.2)	
Sole practitioner	35	63.6	20	36.4	1.0 (0.4–2.3)	

*Reported as median. Data was not evenly distributed due to outliers (41 & 50 years in clinical practice).
[a] Interquartile range.

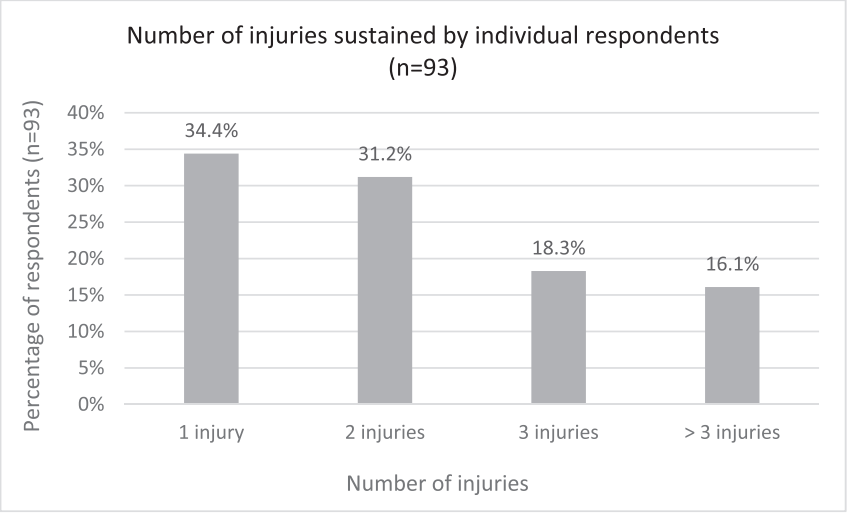

Fig. 2. Number of injuries sustained by individual respondents (n = 93).

respondents (5.5%) thought lifting and moving patients had caused their injury. See Fig. 6 for a summary of activities believed to have caused injury.

Risk factors contributing to injury

To ascertain what may have contributed to injury, we asked participants to select from a range of factors that they believed had increased the risk of their injury occurring (see Fig. 7). Many respondents nominated more than one contributing factor. Working too many hours per week and fatigue were the most common factors. Contributing factors that fell within the option 'other' were lack of fitness, a too-high patient load, patient size, attempting complex effort-dependent techniques beyond the practitioner's physical capacity, and lack of attention to self-protection. Three respondents indicated that returning to work too soon after maternity leave was a contributing factor.

Influence on injury rate of receiving work-related injury prevention training

Participants were asked if they had received training in work-related injury prevention during their osteopathic education. From the sample of 160 respondents, 65% (104) indicated they had received training in work-related injury prevention. Of those who had received training, 58.7% (61) had sustained a WRMI: of those who had not received training 57.1% (32) had sustained an injury ($p = 0.853$). Receipt of training according to respondent characteristics is summarised in Table 3. Having received training was significantly associated with age ($p < 0.001$), with only 14.3% of those over 50 years of age having received training, compared with 85.7% of those in the 26–30 year age group. Similarly, those who had received training had been in practice an average of eight years, compared with 14 years for those who had not received any training ($p < 0.001$). Associates were also more likely to have

Fig. 3. Years in clinical practice when injury occurred.

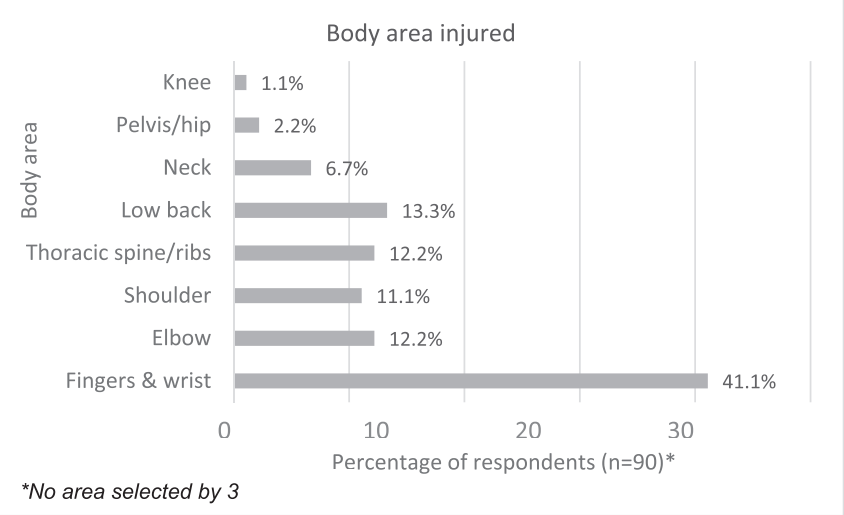

Fig. 4. Body area injured.

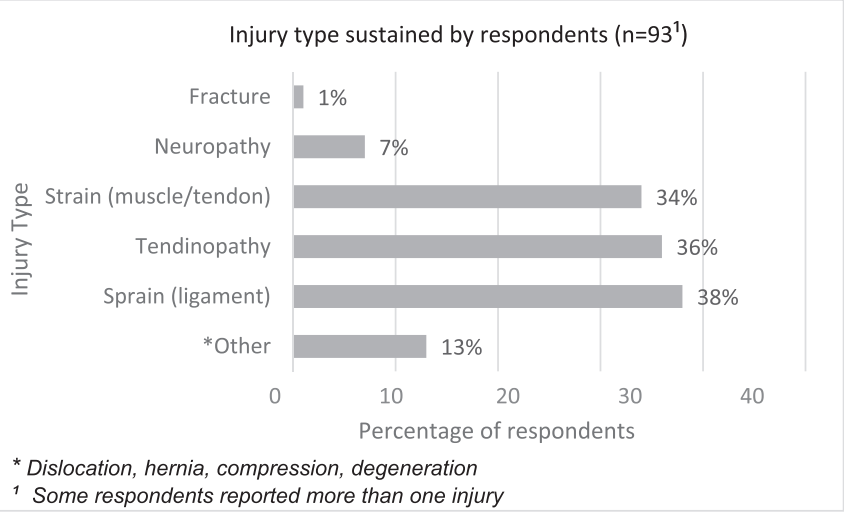

Fig. 5. Injury type sustained by respondents.

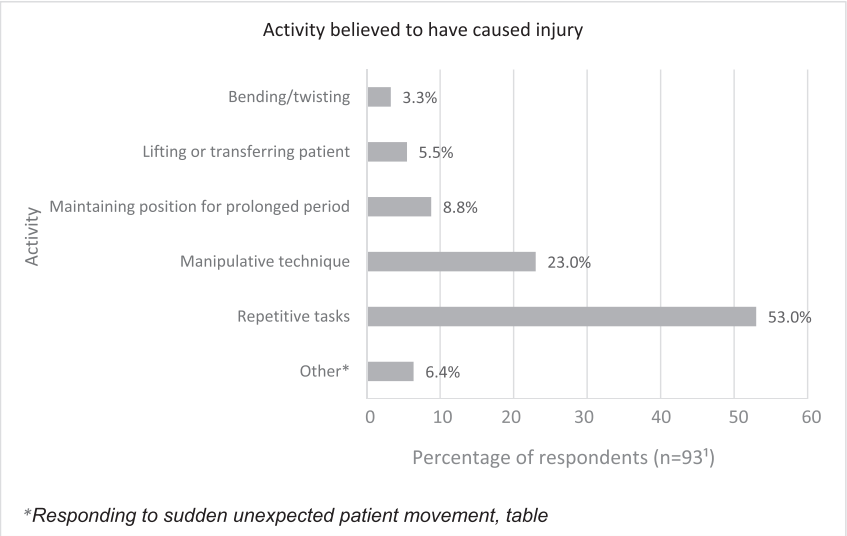

Fig. 6. Activity believed to have caused the injury.

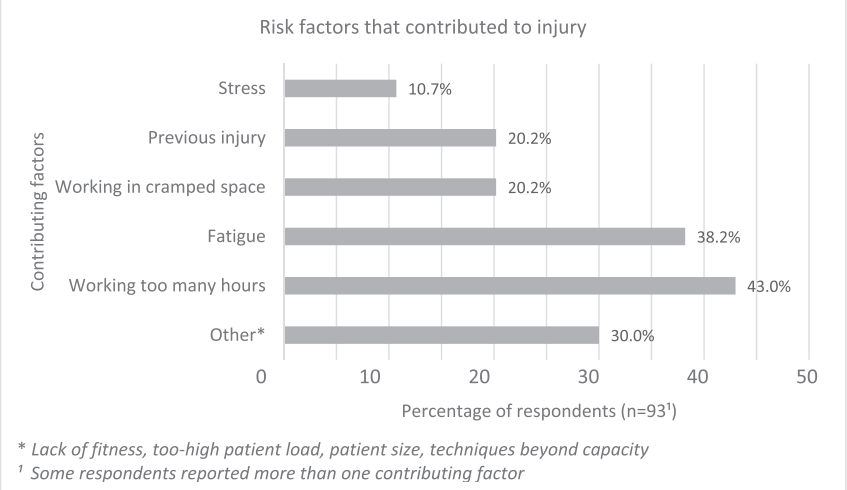

Fig. 7. Risk factors that contributed to injury.

received training than were self-employed practitioners working in a group practice or sole practitioners ($p = 0.020$).

Impact of WRMI and strategies adopted to manage effects of injury

The impact of injury on the respondents prompted the use of various management strategies, including modification to work practices; receiving medical treatment and taking time off work (see Fig. 8). Of the respondents who reported a WRMI, 33.7% ($n = 31$) required time off work because of their injury. Time away from work ranged from 2 days to 2.5 years, with the majority taking between 2 and 4 weeks. A number of respondents (28%) either reduced the number of patients seen per week or decreased the hours spent in clinical practice. Some respondents (9%) were either unable to continue working as osteopaths or needed to change their role within the clinical setting. Two respondents required surgery for their injury.

Several modifications to work practices were adopted by most respondents who had sustained an injury (see Fig. 8). Almost two-thirds of respondents (65%) adopted two or more strategies to manage their injury, while 35% ($n = 33$) using only one. Overall, avoiding techniques that place a load on joints was the main modification reported (61%), followed by changing work position frequently (40%) and decreasing the number of hours worked per week (38%).

Discussion

This is the first research to investigate WRMIs among Australian osteopaths. Of the total respondents, the female–male ratio was slightly higher than the national ratio as published by the registration authority, the Osteopathy Board of Australia, for the period in which the survey was administered [20]. The percentage of respondents under 50 years of age was consistent with national figures. However, the percentage of respondents over 50 years of age was lower than the published national figures.

The findings suggest that osteopaths working in clinical practice in Australia are at risk of WRMIs, with prevalence rates similar to those of other types of manual therapists engaging in similar work activities. Data from this study found that slightly more than one in two osteopaths sustained an injury while undertaking clinical practice. Sixty-six percent ($n = 61$) of the 93 respondents who reported being injured, reported multiple injuries (more than one).

Table 3
Receipt of injury-prevention training according to respondent characteristics.

	Received training		Did not receive training		*p*-value
Gender	*n*	%	*n*	%	0.098
Male	36	58.1	26	41.9	
Female	68	69.4	30	30.6	
Age (years)	*n*	%	*n*	%	<0.001
Under 26	8	66.7	4	33.3	
26–30	30	85.7	5	14.3	
31–40	45	72.6	17	27.4	
41–50	19	51.4	18	48.6	
Over 50[a]	2	14.3	12	85.7	
Years in practice, median (IQR)[b]	8 (3–11)		14 (8–22)		<0.001
Hours worked per week	*n*	%	*n*	%	0.107
<15	11	50.0	11	50.0	
15–30	39	65.0	21	35.0	
30–50	47	66.2	24	33.8	
>50	7	100	0	0	
Work situation	*n*	%	*n*	%	0.020
Associate	36	81.8	8	18.2	
Group practice	37	60.7	24	39.3	
Sole practitioner	31	56.4	24	43.6	

[a] Due to lownumbers of participants over 50, these were grouped to enable more robust analysis.
[b] Interquartile range.

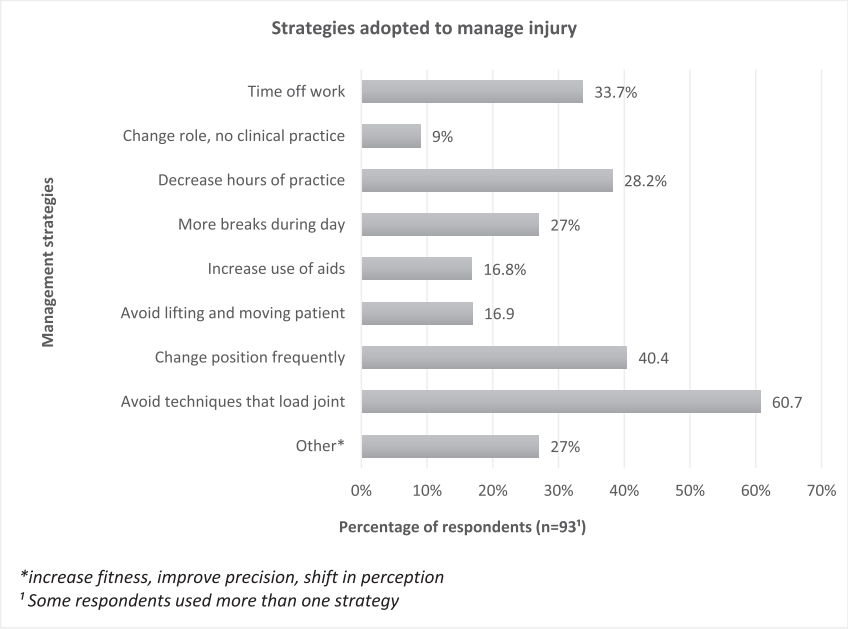

Fig. 8. Strategies adopted to manage injury.

This may indicate that sustaining a WRMI predisposes practitioners to further injury, in particular those who continue working while injured, and should be further investigated.

As with other similar professions, osteopathy requires intense physical exertion, sustained and awkward postures and repetitive movements. In our research, the body part most frequently injured was the fingers and wrist, with 75% of respondents with injury identifying either repetitive tasks, such as soft tissue work, or a manipulative technique as the causative activity, in contrast to studies of PTs and OTs where the low back was the most frequently injured body area, caused when assisting non-ambulant patients [3,11]. Osteopaths work in private practice with ambulant patients (those who are able to move around independently) seeking treatment for muscular and joint dysfunction caused by injury or over-activity, whereas PTs and OTs working in public rehabilitation clinics are often working with patients affected by movement disorders related to conditions such as stroke, motor neurone disease, surgery or fractures.

Research pertaining to WRMIs among therapists who perform similar tasks to those performed by osteopaths has had similar findings to the current study. For example, research by Snodgrass et al. [10] explored WRMIs in Australian PTs who perform joint mobilisation and soft tissue techniques. They found a high prevalence of thumb and wrist pain in the PTs. Most of the PTs believed their thumb pain was a result of joint mobilisation including manipulation, soft tissue massage and trigger-point pressure

therapy [10]. Similarly, research into WRMIs in chiropractors, whose work consists primarily of manipulative techniques, has found a correlation between manipulative techniques and finger and wrist injuries [2].

Although training in work-related injury prevention is currently part of pre-registration osteopathic education in Australia, there is no standardised curriculum across the various university courses. Osteopaths who trained in private colleges either in Australia or overseas may not have received any such training. Of interest was the finding that training in work-related injury prevention did not appear to reduce injury rates among the respondents. Although respondents in our research specified whether they had or had not received training in work-related injury prevention as part of their pre-registration education (65% had received training), our research did not investigate the particulars of their training. It was therefore difficult to draw concrete conclusions regarding these two variables.

Limitations

The results of this research need to be interpreted with caution due to the following limitations. The respondents were volunteers who responded to an email outlining that the research was focused on WRMI. This could have resulted in selection bias with osteopaths without injury not responding to the survey, inflating the prevalence of WRMIs and rendering the findings non-representative of the entire population of Australian osteopaths. Additionally, prevalence rates of body part injured may have been under-estimated because participants who had sustained more than one injury were asked to provide details of only the most serious injury.

Finally, the response rate for this study was low (<10%); the findings therefore cannot be generalised to the entire population of Australian osteopaths. The especially small number of older respondents (>51 years of age) means that the findings may not reflect the effect of ageing on WRMIs in osteopaths. It has been suggested in the literature that research investigating WRMIs may be affected by the healthy worker effect, whereby healthy workers stay in the work force while workers suffering from injury may change to a less demanding profession or retire and, as such, may be less inclined or not available to respond to surveys [21].

Recommendations for further research

Further research with a larger sample and detailed data that includes a larger number of older osteopaths is needed to establish correlations between specific work practices and WRMIs in osteopaths. Attention to research design that helps target older osteopaths and those without injury may prevent non-response. Such research could provide data for the purposes of developing guidelines for use in osteopathic practitioner education. Additionally, research to benchmark training in work-related injury prevention across Australian pre-registration and continuing education courses is recommended. Subsequent review of injury-prevention modules would assist the profession to incorporate evidence-based strategies into courses to promote reduced injury risk for new and experienced osteopaths.

Conclusion

This study provides initial data on the prevalence of WRMIs in osteopaths in Australia. The findings suggests that there is a risk of injury for those working in clinical practice—especially injury to the wrist and the fingers. It also provides insight into the types of injuries sustained, body area injured and the associated contributing factors. Such injuries influence the way osteopaths practice; for example, approximately a third of respondents who had sustained an injury had needed to take time off work.

With osteopathy now one of the fastest-growing health professions in Australia, our research has important implications for the entire profession, including osteopaths, practice managers, educational institutions and regulatory bodies. Further research with a larger sample is needed to identify risk factors specific to osteopathic practice and to inform the development of strategies to reduce injury risk. Such research has the potential to inform the development of specific educational tools to alert students, practising osteopaths and employers of the risks associated with manual therapy and to provide recommendations for safe practice performance and injury prevention.

Ethics approval and consent to participate

Approval for the research was granted by the Southern Cross University Human Research Ethics Committee (approval number ECN-15-226), and consent to use anonymous data for publication purposes was indicated by completing the survey.

Conflicts of interest

There is no conflict of interest.

Acknowledgements

The authors would like to thank Osteopathy Australia for its assistance in administering the survey by distributing the survey link via email to all of its members.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.ijosm.2017.11.003.

Appendix 1

Q1	What is your age?
Q2	What is your gender?
Q3	Where did you receive your osteopathic qualifications?
Q4	How long have you been in osteopathic practice?
Q5	What is your work situation i.e. sole practitioner, group practice self-employed, group practice associate?
Q6	How many hours do you work in clinical practice (excluding administrative duties)?
Q7	Did your osteopathic training include training in work ergonomics?
Q9	Have you ever sustained a work-related injury from working as an osteopath?
Q10	How many WRMIs have you sustained during your osteopathic?
Q11	What body area have you injured? If you have sustained more than one injury please select area of most serious injury.
Q12	Did this injury require you to take time off work?
Q13	How much time did you need to take off work?
Q14	What type of treatment did you seek for this injury?
Q15	How long had you been in practice when you sustained this injury?
Q16	Type of injury i.e. strain, sprain, fracture, tendinosis, other?
Q17	What activity caused your injury?
Q18	What contributing factors were involved?
Q19	What alterations have you made to your work activities due to your injury/s
Q20	Did the injury require you to stop practicing clinical osteopathy?

References

[1] Glover W, McGregor A, Sullivan C, Hague J. Work-related musculoskeletal disorders affecting members of the Chartered Society of Physiotherapy. Physiotherapy 2005;91(3):138–47.

[2] Holm SM, Rose KA. Work-related injuries of doctors of chiropractic in the United States. J Manip Physiol. Ther 2006;29(7):518–23. https://doi.org/10.1016/j.jmpt.2006.06.023.

[3] Darragh AR, Huddleston W, King P. Work-related musculoskeletal injuries and disorders among occupational and physical therapists. Am J Occup Ther 2009;63(3):351–62. https://doi.org/10.5014/ajot.63.3.351.

[4] Bork BE, Cook TM, Rosecrance JC, Engelhardt KA, Thomason MEJ, Wauford IJ, et al. Work-related musculoskeletal disorders among physical therapists. Phys Ther 1996;76(8):827–35.

[5] Gropelli T, Corle K. Nurses' and therapists' experiences with occupational musculoskeletal injuries. Am Assoc Occup Health Nurses 2010;58(4):159–66.

[6] Holder NL, Clark HA, DiBlasio JM, Hughes CL, Scherpf JW, Harding L, et al. Cause, prevalence, and response to occupational musculoskeletal injuries reported by physical therapists and physical therapist assistants. Phys Ther 1999;79(7):642–52. https://doi.org/10.1093/ptj/79.7.642.

[7] Passier L, McPhail S. Work-related musculoskeletal disorders amongst therapists in physically demanding roles: qualitative analysis of risk factors and strategies for prevention. BMC Musculoskelet Disord 2011;12(1):24. https://doi.org/10.1186/1471-2474-12-24.

[8] Cromie JE, Robertson VJ, Best MO. Work-related musculoskeletal disorders in physical therapists: prevalence, severity, risks, and responses. Phys Ther 2000;80(4):336–51. https://doi.org/10.1093/ptj/80.4.336.

[9] Chan J, Spenser J. Adaptation to hand injury: an evolving experience. Am J Occup Ther 2004;28:128–39. https://doi.org/10.5014/ajot.58.2.128.

[10] Snodgrass S, Rivett D, Chiarelli P, Bates A, Rowe L. Factors related to thumb pain in physiotherapists. Aust J Physiother 2003;49:243–50.

[11] Campo M, Weiser S, Koenig KL, Nordin M. Work-related musculoskeletal disorders in physical therapists: a prospective cohort study with 1-year follow-up. Phys Ther 2008;88(5):608–19. https://doi.org/10.2522/ptj.20070127.

[12] West DJ, Gardner D. Occupational injuries of physiotherapists in north and central queensland. Aust J Physiother 2001;47(3):179–86.

[13] Salik Y, Ozcan A. Work-related musculoskeletal disorders among Israeli physical therapists. Physiother Res Int 2004;15(3):176–84.

[14] Rozenfeld V, Ribak J, Danziger J, Tsamir J, Carmeli E. Prevalence, risk factors and preventative strategies in work-related musculoskeletal disorders among Israeli physical therapists. Physiother Res Int 2010;15(3):176–84.

[15] Homack D, Hedge A. Survey of occupational injuries to practicing chiropractors. Austin J Musculoskelet Disord 2016;3(2):1036–8.

[16] Wajon A, Ada L. Prevalence of Thumb pain in physical therapists practicing spinal manipulative therapy. J. hand Ther 2003;16(3):237–44.

[17] Google. Analytic solutions surveys: Google. Available from: https://www.google.com/analytics/surveys/#?modal_active=none; 2016.

[18] OsteopathyAustralia. About osteopathy: osteopathy Australia. Available from: http://www.osteopathy.org.au/pages/about-osteopathy.html; 2016.

[19] McLeod GA, Annels K, Cohen J, Edwards S, Hodgins D, Vaughan B. Work related musculoskeletal injuries sustained by Australian osteopaths: qualitative analysis of effects on practitioner health, clinical practice, and patient care. Chiropr Man Ther 2017:25. https://doi.org/10.1186/s12998-017-0158-7.

[20] Osteopathy Board of Australia. Osteopathy registrant data. Australian Health Practitioner Regulatory A; 2015.

[21] King P, Huddleston W, Darragh AR. Work-related musculoskeletal disorders and injuries: differences among older and younger occupational and physical therapists. J Occup Rehabilitation 2009;19(3):274–83.