James, C., James, D. & Nie, V. et al. (2018) Musculoskeletal discomfort and use of computers in the university environment, Applied Ergonomics, 69, May, p 128-135

Available from: http://dx.doi.org/10.1016/j.apergo.2018.01.013

Abstract

This cross-sectional study investigated musculoskeletal discomfort and computer use in university staff, through the use of online questionnaires. Results showed a high prevalence of staff reported musculoskeletal discomfort during the preceding year (80%), with neck (60%), shoulder (53%) and lower back discomfort (47%) being the most common. Most believed discomfort was caused by work, although neck discomfort was significantly less in those reporting excellent mental health (OR 0.44, $p<0.01$). Computer navigation was performed primarily by mouse (77%); however, using a touch pad increased the odds (OR 1.17, $p<0.01$) of wrist discomfort and the belief it was caused by work (OR 1.19, $p<0.01$). Few staff attended ergonomic training (16%) or requested workstation assessments (26%). However, high rates of staff reporting musculoskeletal discomfort sought professional treatment (range: 35.2% wrist/hand to 65.0% shoulder). Strategies are needed to address uptake of preventive measures and reduce reliance on medical treatments following musculoskeletal discomfort in universities.

KEYWORDS

Musculoskeletal, Computer, University.

1. Introduction

In Australian universities, the use of computers and electronic administration systems has increased exponentially in the last decade (1) leading to a marked increase in the number of hours academics and administrative staff spend on computers. Academic core activities of teaching and research are increasingly being conducted using computing software and the internet, and academics, as well as administrative staff, are sitting for long hours with potentially deleterious health effects. Prolonged computer use is recognised as an occupational risk factor for musculoskeletal disorders (2). Whilst the association between musculoskeletal symptoms and increased hours of computer use, including mouse use has been previously studied within the general office environment (3, 4), there is very limited research specifically related to musculoskeletal symptoms associated with computer based tasks undertaken by academics in context with an extended range of operational environments. Academics are more likely to work in diverse operational environments, and therefore the relationships between their musculoskeletal symptoms and computer use may be different to what is observed in standard office environments (5). Prolonged sitting at computers has also raised concerns about the impact of a lack of variation in working postures and activity on worker health and wellbeing (6).

The rapid development in communication technologies, including the availability of smart phones, tablets and laptop computers, has provided opportunities for working away from the office work station. This is increasingly commonplace among office workers (7). Academics have very variable work environments and use computers within offices, laboratories, at home and when travelling. They are expected to be 'mobile' and available to respond to queries, regardless of location. The expectation of availability outside of office hours has been identified as a concern for many professionals and a range of reasons for completing work at home has been identified, including working unpaid overtime to complete the demands of the job (7). In many instances academics therefore may not be working at designated workstations purposely set up for them. Potentially they are less likely than university administrative staff to use single fixed workstations designed to minimise ergonomic risks and the extent to which academics apply design recommendations to alternate workstation and equipment configurations is also unknown.

Numerous studies have investigated methods of reducing musculoskeletal pain associated with using computers. Prevention strategies found to be effective include adjusting equipment to individual requirements, using ergonomic keyboards and taking regular breaks (8, 9). Data on the prevalence of musculoskeletal disorders among computer users are published (10). However, the data are largely self-reported, with few clinical diagnostic data available and there is a paucity of government-reported lost time injury data specifically related to computer use (6). Although there has been considerable interest in the health effects of computer work on office workers (4), findings relating work posture to upper limb and neck symptoms have been inconsistent (11, 12).

The Australian academic population is changing and academics are leaving the profession (1). In Australia, academics include all research, teaching and clinical educator staff who are involved in a range of teaching and research activities. There are however, differences in the naming and definition of academic staff in other countries (13). Workload has been cited as a possible reason, but the development of musculoskeletal symptoms and/or other health concerns may also be contributing factors. Whilst there is little published research investigating potential health effects of computer use specifically in academics, one study on academics in a university in Hong Kong did demonstrate a significant association between head posture and neck pain when computer processing (14). However, it is unclear whether these findings can be generalised to other musculoskeletal symptoms. The Australian academic profession is also rapidly ageing (15) and with symptoms such as neck pain being more prevalent in older Australians (16), the potential problem of musculoskeletal disorders is likely to worsen.

The aim of the current study is to determine the prevalence of musculoskeletal symptoms in university academic and administrative staff and to investigate the relationships between these symptoms and workstation configuration, working postures and ergonomic training.

2. Methods

A cross-sectional study design was used to survey University of Newcastle employees regarding the prevalence of musculoskeletal discomfort, workstation configuration, work postures, and ergonomic training**.** In this study, workstation refers to any environment or equipment in which university staff were using a computer, laptop or tablet device.

2.1. Participants

All staff members (teaching and research academics and administrative staff) from The University of Newcastle were invited to participate in the study. A staged approach to recruiting participants was used. Initially, a flyer notifying staff of the upcoming survey was distributed to all employees via the University internal mail and staff noticeboards. An "All Staff" email was also sent advising staff of the study. A second email was sent one week later which invited staff to participate in the study and provided a link to an online questionnaire. A participant information sheet was provided which explained the rationale for the study, the intended inclusion criteria of permanent full time and part time staff members employed for more than 19 hours per week, and that participation was voluntary. Consent was implied by completion of the survey. Two reminder emails were sent to encourage participation.

Ethics approval was provided by the University of Newcastle Human Research Ethics Committee.

2.2. Design

A questionnaire was developed and consisted of 58 questions which covered the following areas: demographic information, workstation configuration and use, ergonomic training undertaken, musculoskeletal discomfort, and work-life balance. The questionnaire was developed from existing literature on workstations and musculoskeletal discomfort (17, 18).

The questionnaire was piloted by academics from a single teaching unit in the University, prior to distribution. Following piloting, the questionnaire was modified to improve the clarity of some items and reduce the time needed to complete the survey.

Permission was obtained to select specific items for working postures from the questionnaire used by IJmker et al. (17). Specific sections from the standardised Nordic questionnaire were used (18).

Participants were asked to indicate if they had ever experienced musculoskeletal discomfort and if they had experienced discomfort during the last seven days and during the previous 12 months. Musculoskeletal symptoms were defined as those causing discomfort in the neck, shoulder, upper back, elbow, low back, wrist/hand, hip/thigh/buttock, knee or ankle/foot. Participants were asked to rate the severity of discomfort in each body area on an eleven point numerical continuous rating scale (zero – 10 where 0= 'No pain' and 10= "Worse possible pain). They were also asked if they had visited a health professional because of their musculoskeletal discomfort, and whether they believed discomfort was caused by work.

Participants were asked to describe workstation configuration using selections that included the diagrams previously published by IJmker et al (17). They were asked whether they worked at multiple workstations including the type of workstation (desktop, laptop, tablet), although detailed questions describing the workstation were based on a single workstation, defined as the 'main' workstation or the one participants spent most time using. They were asked about the time they spent on computers (On average, how much time do you spend on a computer every week? and On average, how much time do you spend doing desk work per week?); also whether they used an irregular non-adjustable work position such as on the train, in a hotel, on the couch etc. Participants were asked about the position and height of the monitor and the position of the lower limbs in relation to the height of the desk. Participants were also asked about the postures they used while working (see Figures 1 and 2). Participants were also questioned about types and placement of input devices, such as keyboards and types of mouse used (standard, tracking, touch pad). Explanations of input devices were given to assist correct interpretation, such as diagrams of a mouse with and without scroll wheels and descriptors of touchpad of a laptop (you can move the cursor on the screen by touching this compartment with your (index) finger).

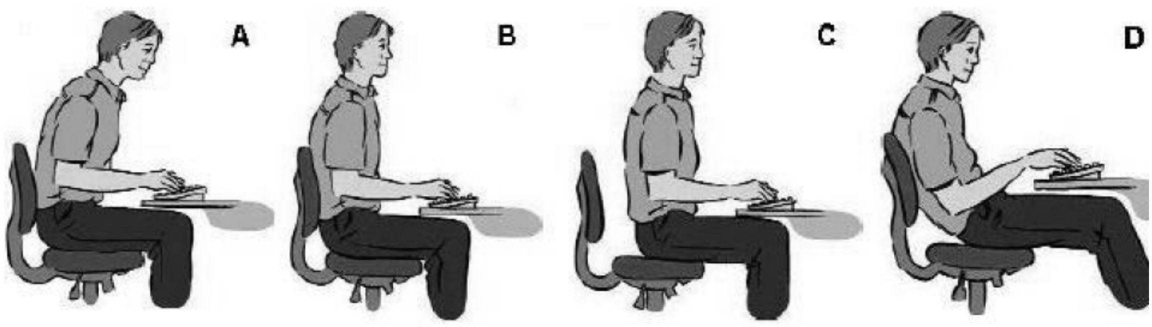

Figure 1: Possible positions in which participants may sit, including variable (altering position at least once per half hour (16).

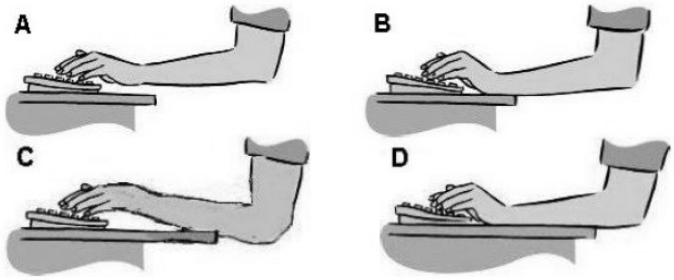

Figure 2: Diagrams selected by participants to describe their wrist and hand positions while typing. Position A was selected by 29% (n = 81) of participants, B 31% (n = 85, C 20% (n = 55) and D 20% (n = 55). Positions showing the wrist or lower arms leaning on the desktop or armrest of chair (16).

Lastly, they were asked about any ergonomic interventions they had received; specifically, whether they had attended ergonomic training offered by the University, whether they had read documents explaining ergonomic safety at the workstation from the University Health and Safety Team, and whether they had requested an individual ergonomic assessment from the Health and Safety Team. The questionnaire was administered as an online survey via Survey Monkey™ during the last quarter of 2012. Work-life balance responses are not reported in the current paper and will be considered in a separate manuscript.

2.3. Statistical Analysis

Data were checked for normality with normal data reported using mean (±standard deviation) and non-normal data using median (interquartile range). Missing responses were excluded on an analysis by analysis basis. Pearson's chi-square (chi2) was used to analyse differences in proportions. When categorical data showed a significant difference by chi2, all responses were compared against the most ergonomically correct reference response to determine outcomes in terms of an odds ratio (with 95% confidence interval and p values). For example, in figure 1, position B was determined to create the most support and used as the reference position against A, C, D and E (mix of positions). Analysis of combined academic and administration data in supplementary tables 1-3 were performed with logistic regression. Significance was determined at the 5% level. All statistical analyses were performed in Stata version 12.1 (19).

3. Results

Respondents in this survey were both academic and professional staff members from the University of Newcastle, Australia, which has in excess of 37000 students enrolled and 2300 fulltime, part-time and casual staff employed across five faculties. A total of 302 participants (43% male, 51% academic staff, 14% employed part-time) responded to the survey. Respondents who only partially completed the survey were included, however one respondent did not provide any demographic details and was therefore excluded. This resulted in 301 participants being included in the analyses. Table 1 summarises the gender distribution; employment status (academic or administrative staff, full or part-time), average hours worked per week and the ergonomic training undertaken be participants.

Table 1:Participant demographics

	Academic (n=154)	Administrative[a] (n=147)	Total (n=301)[b]
Male	50 (16.6%)	40 (13.3%)	90 (29.9%)
Female	104 (34.6%)	106 (35.2%)	210 (69.8%)
Average age (mean±sd)	46.3±11.6	43.5±12.0	44.9±11.8
Full time staff	119 (39.5%)	119 (39.5%)	238 (79.1%)
Part time/Casual staff	35 (11.6%)	28 (9.3%)	63 (20.9%)
Average hours worked in last 4 weeks			
Full time (mean±sd)	47.2±10.6	37.6±5.9	42.4±9.8
Part time (mean±sd)	31.9±15.8	26.6±13.3	28.9±14.5
Attended workstation ergonomic training	15 (5.1%)	32 (11.0%)	47 (16.1%)
Viewed ergonomic documents	60 (20.5%)	69 (23.6%)	129 (44.2%)
Requested workstation assessment	35 (12.0%)	42 (14.4%)	77 (26.5%)

[a]all non-academic staff.
[b]Not all participants provided answers to all questions, therefore total numbers and percentages vary. Percentages are by the total number of people who provided a response to that question.

3.1. Musculoskeletal discomfort

Most participants reported good to excellent physical and mental health, with no difference between academic and administrative staff, or by gender (Table 2). However, a large percentage of participants (92%) had experienced musculoskeletal discomfort previously. Most of the participants had experienced musculoskeletal discomfort previously (92%), with a large proportion of these reporting that the discomfort was experienced more recently, i.e. within the last 12 months (78.7%, n=237) or the previous seven days (66.5%, n=200). The most common musculoskeletal regions reported as causing discomfort within the previous 12 months were the neck and shoulder, followed by the lower and upper back. Most participants (n = 240, 77.9%) believed their discomfort was caused by work, with no differences between academic and administrative staff in the prevalence of discomfort or the belief that discomfort was caused by work (Figure 3).

Table 2: Participants self-reported rating of physical and mental health (n=300)

	Excellent	Very good	Good	Fair	Poor
Physical Health	43 (14.3%)	131 (43.7%)	97 (32.3%)	26 (8.7%)	3 (1.0%)
Mental Health	67 (22.3%)	128 (42.7%)	69 (23.0%)	30 (10.0%)	6 (2.0%)

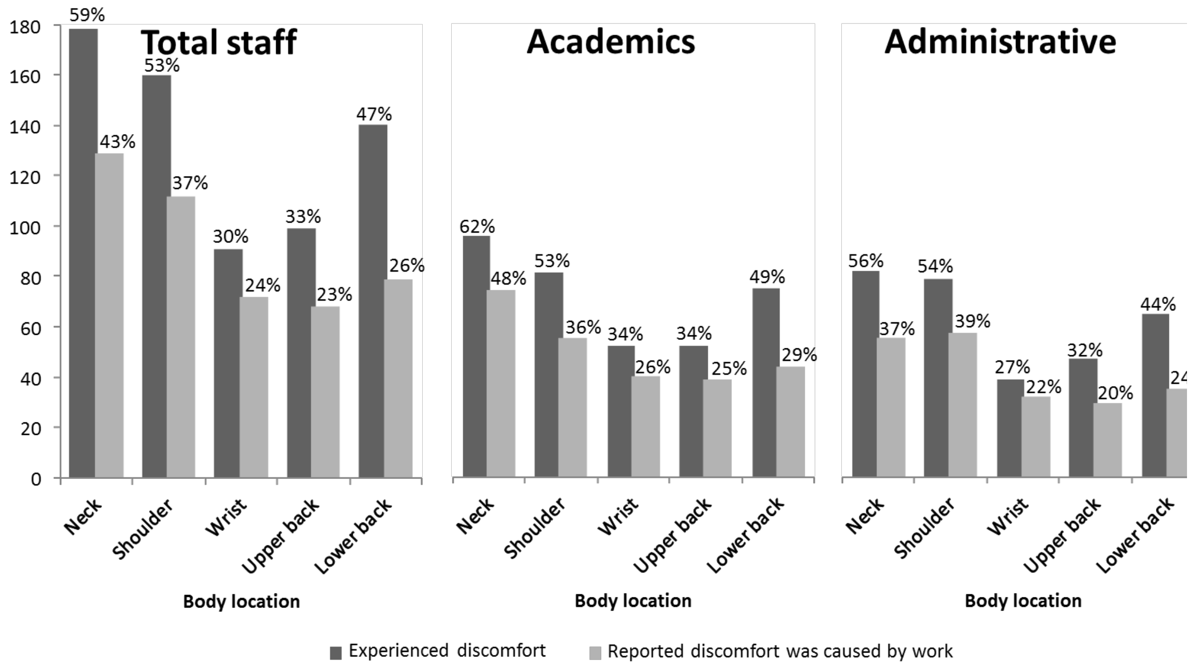

Figure 3: The number of participants who experienced musculoskeletal discomfort in the last 12 months and thought this discomfort was caused by work, by body region.

Variables describing participant reports of musculoskeletal problems are shown in Table 3. Participants who reported their mental health as 'excellent' were less likely to report neck discomfort (OR 0.44, 95% CI 0.24-0.81, p=0.008) than those with 'good' mental health. Treatment from health professionals was most commonly sought for neck, back and shoulder discomfort (61.8-65.0%), with less treatment sought for wrist/hand discomfort (35.2%).

Table 3: Severity of pain reported in musculoskeletal areas and whether treatment from a health professional was sought.

	Pain Scores[a] (mean±st.dev.)			Sought treatment from any health professional		
	Academic	Administrative staff	Total[b]	Academic	Administrative staff	Total[c]
Neck	4.54±2.19 (n=91)	4.47±2.40 (n=81)	4.51±2.29 (n=172)	54 (56.3%)	56 (68.3%)	110 (61.8%)
Shoulder	4.65±2.06 (n=78)	4.77±2.34 (n=77)	4.71±2.20 (n=155)	50 (61.7%)	54 (68.4%)	104 (65.0%)
Wrist/hand	4.36±2.24 (n=47)	4.41±2.42 (n=37)	4.38±2.31 (n=84)	20 (38.5%)	12 (30.8%)	32 (35.2%)
Upper back	4.85±2.04 (n=48)	4.78±2.50 (n=45)	4.84±2.26 (n=93)	32 (61.5%)	31 (66.0%)	63 (63.6%)
Lower back	5.12±2.42 (n=69)	4.92±2.27 (n=61)	5.02±2.34 (n=130)	45 (60.0%)	43 (66.2%)	88 (62.9%)

[a]*Participants were asked to rate the severity for each region, using 0 (no pain) to 10 (worst possible pain) as a numeric scale.*
[b]*Total includes those who reported discomfort for the area and provided a rating of the pain.*
[c] *Participants were asked whether they visited a health professional for that region of discomfort. Percentages in brackets*

represent the proportions of those who reported discomfort in the stated area and visited a health professional.

3.2. Workstation configuration

The majority of participants (77%) reported working more than 20 hours per week on a computer, with no differences between academics and administrative staff. There was no association between reported musculoskeletal discomfort and working more or less than 20 hours a week at the computer (X^2=0.600, p=0.467). Thirty-six percent (n = 104) of participants indicated they only worked at a single workstation. The remaining 64% worked in a variety of additional settings at work, home, or while travelling, most commonly at the dining table (n = 94 of participants, 31%) and on the couch (n = 68, 22.5%). More academics worked at multiple workstations (n = 115, 77 %) than administrative staff (n = 70, 50%) but there was no association between working at multiple workstations and musculoskeletal discomfort in either group.

At the main workstation, most participants reported the monitor was positioned directly in front of the keyboard (n = 250, 88%), with the remainder having the monitor at the left or right of the keyboard, with no difference demonstrated between academic and administrative staff. More administrative staff (n = 74, 86%) than academic staff (n = 62, 70.5%) had the monitor placed at eye level or a little lower. For those not in this position, more participants had the monitor higher than eye level (academics n = 17, 19%, administrative n = 11, 13%) compared with lower than eye level (n = 9, n = 1). There was no association between monitor height and having neck discomfort or any other discomfort.

Most participants (87%) reported using a standard keyboard at the main workstation, although some indicated they used compact keyboards such as those found on laptops (11%) or split keyboards (2%). The type of keyboard used was not associated with whether or not a participant reported musculoskeletal discomfort. More academics than administrative staff frequently used touch pads (academics 33%, administrative staff 8%, X^2 = 26.86, p= <0.001) and compact or laptop keyboards (academics 19%, administrative staff 3%, X^2 = 18.32, p=<0.001). Computer navigation methods impacted on reported wrist/hand discomfort, whether staff thought this localised pain was caused by work and whether they sought treatment for it (see Table 4).

Table 4: **Preferred computer navigation methods and odds ratios of reported wrist/hand discomfort, belief discomfort is caused by work and whether a health professional was visited.**

	Academic (n=154)	Administrative (n=147)	Total (n=301)	Reported wrist/hand discomfort		Wrist/hand discomfort caused by work		Visited a health professional for wrist/hand treatment	
				OR (95% CI)	*P value*	*OR (95% CI)*	*P value*	*OR (95% CI)*	*P value*
mouse	118 (76.6%)	114 (77.6%)	232 (77.1%)	1.18 (0.65-2.15)	0.579	1.23 (0.66-2.32)	0.551	0.58 (0.27-1.26)	0.169
touchpad	47 (30.5%)	12 (8.2%)	59 (19.6%)	1.17 (1.06-1.29)	0.002	1.19 (1.08-1.31)	0.001	1.20 (1.05-1.36)	0.005
Other input devices[a]	16 (10.4%)	18 (12.2%)	34 (11.3%)	1.98 (0.96-4.11)	0.065	1.63 (0.76-3.47)	0.206	3.48 (1.47-8.29)	0.005

[a] *Other input devices include trackball mouse, joystick mouse, pen and tablet, track point of a laptop and other unlisted methods of computer navigation.*

Most participants indicated chair height at the main workstation allowed them to put their feet flat on the floor with their hips horizontal to their knees (n = 248, 88%). However, some reported that the chair height prevented their feet reaching the floor (n = 27, 10%) or that they were positioned with their knees higher than their hips (n = 8, 3%). There was no difference in chair height relative to foot position between academic and administrative staff. However, a chair height where the feet could not reach the floor was significantly associated with having musculoskeletal discomfort ($X^2 = 8.10$, p = 0.007). This relationship was consistent for both academics and administrative staff, but independent analyses of these groups only reached significance for administrative staff.

3.3. Working postures

Of the possible posture positions shown in **Error! Reference source not found.**, 31% of participants indicated that they sat in position B (straight), 25% sat in position A (leaning forward), and 25.5% reported sitting in variable positions changing at least once every 30 minutes. Participants were significantly more likely to experience upper back discomfort if they sat in position A (OR 4.69, 95% CI: 1.88-11.70, p=0.001) or position C (OR 8.38, 95% CI: 2.56-27.42, p<0.001) when compared with Position B. There were no significant differences in reported postures between academic or administrative staff.

In relation to elbow and wrist positions, administrative staff more commonly reported elbow height was the same level as the keyboard at the main workstation (administrative n = 115, 83%, academic n = 94, 63.5%, p<0.001). Participants tended to lean on their arms or wrists when typing, with a total of 71% reporting they used postures B, C or D shown in Figure 2. There was no difference between academic and administrative staff in reported elbow /wrist position, and this was not associated with whether or not a person reported musculoskeletal discomfort.

3.4. Ergonomics training and assessment

There was limited uptake of ergonomic services available to staff with only 26% (n = 77) of participants indicating they had requested an individual workstation assessment and 16% (n=47) of staff attending Workstation Ergonomics Training offered through the University Professional Development Unit. Significantly more administrative (n = 32, 23%) than academic staff (n = 15, 10%) indicated they had attended this training session ($X^2 = 8.79$x, p=0.004). There was no difference in the percentage of academics (n = 60, 40%) and administrative staff (n = 69, 49%) who had read the "Safety in the Workplace: Ergonomics" documents prepared by the University Health and Safety Team. Participants who attended Workstation Ergonomics Training were more likely to read ergonomic documents ($X^2 = 12.98$, $p<0.001$) and request a workstation assessment ($X^2 = 17.43$, $p<0.001$). Those who read the documents but did not attend the training session were also more likely to request a workstation assessment ($X^2 = 16.83$, $p<0.001$). Attending Workstation Ergonomics Training, reading workplace safety documents, and requesting individual workstation assessments were not associated with having musculoskeletal discomfort in an analysis of all participants. However, academics with musculoskeletal discomfort were more likely to read workplace safety documents (90% of those with discomfort, n = 54) than academics without discomfort (10%, n = 6, $X^2 = 4.81$, p=.033).

4. Discussion

This study investigated the prevalence of musculoskeletal discomfort in academics and administrative staff working in a typical university environment in Australia, and explored the relationships between discomfort and working positions. A large proportion of university staff experienced musculoskeletal discomfort and the majority believed discomfort was caused by their work. Working postures at the workstation showed increased occurrence of upper back discomfort if not in a properly supported posture. Of those reporting discomfort, the majority of staff sought treatment from a health professional.

4.1. Participants

Participants in the current study were representative of the Australian higher education sector with regard to gender and employment status (20). In the current study, 45% of participants were male and 14% were part-time. This is similar to data reported for Australian universities (43% male and 12% part-time, (20)). However, the proportion of academics was slightly greater in the current study (51%) than that reported for Australian universities (43%, (20)). This is likely due to the recruitment methods that included an email invitation specifically seeking academic staff participation. Academic staff members were targeted in the current study because they are underrepresented in the literature on musculoskeletal discomfort in workers in office environments. This focus on academics may have resulted in fewer administrative staff participating, which may limit generalizing the findings to all university staff.

4.2 Musculoskeletal discomfort

In this study over 90% of all participants reported that they had experienced musculoskeletal discomfort at some time in the past. Given the mean age of participants was 45 years, it is probably not surprising that almost all had experienced musculoskeletal discomfort at some point in their lives. The 12 month prevalence rate of musculoskeletal discomfort was 78.7%. Griffith et al. (21) reported a similar 12 month prevalence rate of over 70% in their Australian study of musculoskeletal discomfort associated with computer work in a range of public service occupations. Their study also used a self-reported on-line questionnaire, using selected items on musculoskeletal discomfort derived from the Nordic questionnaire (18), so their criteria for determining symptom prevalence were comparable. The current study found 12 month prevalence rates were greatest for musculoskeletal discomfort in the neck (59%), shoulder (53%), and lower back (47%). Griffith et al (21) also found that neck discomfort, followed by shoulder then lower back discomfort were the most prevalent, but the rates in their study were somewhat higher than in the current study.

Huisstede et al. (22) systematically reviewed studies investigating the prevalence of upper limb musculoskeletal disorders and for studies using self-reported data, the recorded point prevalence rates varied from 30 – 53%. In the current study the self-reported prevalence rate for discomfort reported in the last seven days was 40% for all musculoskeletal discomfort, including the upper limb. The point prevalence rate is normally described as the prevalence at a single point in time, but is sometimes reported as a seven day rate and the results of the current study are therefore consistent with the findings of Huissted et al.

Approximately 70% of participants reporting neck, shoulder or upper back and 60% reporting lower back discomfort thought the discomfort was caused by work. Our study did not find any significant difference in reported symptom levels between academic and administration staff despite the thought that a less regulated workstation environment of an academic might have placed them at greater risk of musculoskeletal symptoms. Computer use is recognised as an occupational risk factor for musculoskeletal disorders (2-4) in general and our study suggests this is no different for academics. Although wrist discomfort was reported less often, it was thought to be caused by work most frequently (80%). However, participants with wrist/hand discomfort were the least likely to have consulted a health practitioner. Only 35% of participants who reported wrist/hand discomfort consulted a health practitioner about it, compared with 60-65% for neck, shoulder, upper and lower back discomfort. The average pain score for wrist discomfort was the lowest reported for any body part (4.38±2.31) and it is possible that the wrist pain was considered too mild to warrant further clinical investigation. However, none of the average pain scores for any body part was high (range 4.48-5.05) and in general pain associated with musculoskeletal discomfort was reported as mild or moderate only.

The decision to consult a health practitioner may be influenced by a number of factors. Australia is covered by a subsidised medical system (Medicare) that includes reduced costs for services such as visits to general practitioners (23). Services not included in Medicare are generally covered by private health insurance and approximately 57% of Australian adults hold this type of insurance (24). Access to these health services at subsidised rates may be a factor on the high uptake of services for musculoskeletal discomfort as demonstrated here. Other factors impacting on the uptake of services may include perceptions of severity of discomfort, dysfunction, ability to perform activities of daily living (including work activities), as well as the perceived cause of discomfort. In the current study, believing discomfort to be caused by work does not appear to be the major driver for consulting a health practitioner. No specific details on workplace injury and computer use are available in the Australian academic population; therefore, it is not known if self-report of musculoskeletal pain as a result of computer use correlates with the numbers of work-related injuries.

Almost all participants rated their mental and physical health as good, very good or excellent. Participants reporting their mental health as excellent were significantly less likely to report neck discomfort than those reporting just good mental health, which supports previous observations that poor psychological health is a risk factor for neck pain (25, 26).

4.2. Workstation configuration and variety of workstations

Technology is increasingly being used both at work and at home and there are now many opportunities for work away from the more traditional office workstation (7). This is consistent with the findings from this study, particularly in relation to academic staff. Academics used a variety of workstations both on and off university premises, including dining tables and couches. Academics, as with other professionals, commonly take work home and there is an expectation that they are 'mobile. The 'mobile' workstation may account for the increased frequency of use of compact keyboards and touch pads by academics when compared with administrative staff. The increased reporting of wrist discomfort with increased use of a touch pad is consistent with the findings of Kelaher et al (27) who found touchpad location significantly affected posture discomfort. Lin et al (28) suggest that as a touch pad requires a single point of contact for use, a consequence is greater index-middle finger spread and greater extension to avoid unintentional contact with the surface. The relationship between the use of a touch pad and wrist/hand discomfort is interesting as nearly two thirds of participants in this study used an alternate computer when working away from the office and similarly nearly two thirds used a laptop or tablet for this – whether administrative or academic staff. Although laptops and tablets can be used with an external mouse it is possible that they are more often used with integral touch pads. Similarly, Baker and Moehling (29) also found the position of the keyboard has the greatest effect on the position of the shoulder, elbow and wrists and therefore may account for some of the findings in this study.

Good ergonomic practice recommends the computer monitor to be placed directly in front of the keyboard at eye height or a little lower, when at a fixed desk workstation (30). In this study more administrative staff than academics had the monitor at this height. This may reflect a more regulated work environment and less mobility in the workstation compared with academic staff, or may be the result of more awareness by administrative staff of ergonomic principles, as more of them had attended ergonomic training.

4.3. Working postures

In the current study there were no significant differences between academic and administrative staff with respect to reported seated posture at the main workstation. Therefore, work role does not appear to affect self-selected posture. Approximately one-third of all participants adopted the recommended upright posture with lumbar support (position B in Figure 1). Upper back discomfort was significantly more likely to occur in participants leaning forward with a kyphotic or flexed thoracic spine (Figure 1; A) or upright with no lumbar support (Figure 1: C) than in those adopting the ergonomically recommended position (Figure 1: B). Furthermore, if the chair height did not permit placement of the feet on the floor, there was a significant increase in the reporting of musculoskeletal discomfort. Reduced muscle activation has been shown to be associated with postures judged as ergonomically correct (31). Baker and Moehling (29) concluded that the relationship of the keyboard height to elbow height plays an important role in computer workstation postures. They also found an association between monitor height and neck flexion and seat height and wrist extension, which all impact upon the working posture when seated at a computer workstation, however they were unable to show that awkward postures lead to musculoskeletal symptoms. In this study there was no association between monitor height and neck discomfort despite an association between head posture and neck pain when computer processing being found by Chui (14) in a study of Hong Kong academics. The postures associated with increased discomfort in the current study are ones generally accepted as less ergonomically correct, consistent with McLean's observations (31). The individual differences of workers, perceptions of musculoskeletal symptoms and work situations may all impact and further research into this area is recommended.

4.4. Ergonomic training

Attendance at Workstation Ergonomics Training was significantly associated with uptake of work station assessments, suggesting the training raised awareness of the importance of individual ergonomic assessment of computer set-up. Given the overall uptake of formal Workstation Ergonomics Training was only 10% of academic staff and 23% of administrative staff, there is clearly scope for more targeted education on the health risks of computer work and appropriate prevention strategies in staff induction training in the university. Korunka et al (32) suggest that implementation of ergonomic training may be more successful if the usefulness of ergonomic strategies is conveyed to staff, with demonstrated support from supervisors and managers. Significantly more administrative staff than academic staff reported that they had attended Workstation Ergonomics Training, which is consistent with the results suggesting administrative workstations are more likely to be set up according to recommended ergonomic practice (e.g. more had the correct monitor placement).

Workstation Ergonomics Training provides workers with knowledge and skills to optimise their workstation configuration and work postures. Previous studies have reported on the beneficial effects of office ergonomics training. Training has been shown to impact on behavioural changes and workstation practice, improve work postures, and reduce musculoskeletal complaints and stress among computer users (33). Awareness of ergonomic practice and intervention strategies to reduce musculoskeletal complaints potentially leads to an increased ability to identify risks in the work environment and change behaviours to minimise their impact. Other studies report improved body postures and workstation practices following office ergonomic training, which in turn lead to a reduction in reported musculoskeletal discomfort and stress (34, 35). In contrast, data from the current study suggest there is no relationship between having completed Workstation Ergonomics Training and the presence of musculoskeletal discomfort. This is likely due to the small numbers of participants in the current study who had undertaken any ergonomic intervention. The results instead indicate a high uptake of medical treatment following symptoms of discomfort. It is also unclear from this study whether participants requested ergonomic training because they had symptoms or to prevent symptoms developing and additional studies to investigate this further are recommended.

5. Strengths, Limitations and Future Research

This study focussed on musculoskeletal discomfort and computer use in academics; a large population internationally who work in a variety of environments and for whom there is limited literature investigating this relationship. Data were collected from a cross-sectional survey of Australian academics from a single regional institution therefore the responses may not be characteristic of all university institutions. Out of a possible 2300 eligible staff members invited to participate in the study the 302 respondents represent a response rate of 13%, which, while less than optimum, still represents an important and significant contribution to the limited literature existing on this topic. Incomplete surveys were included so items were analysed with varying response rates. All data on musculoskeletal discomfort were self-reported using the validated items of the Nordic questionnaire (18). However, additional objective clinical assessment of symptoms could be included in future research to corroborate the self-reports. The self-reported data on musculoskeletal exposures were derived largely from questions selected from the IJmker, Mikkers and Blatter study (17) on the reliability and validity of questions assessing work station and work postures when doing computer work and they concluded the questions were reliable for the assessment of workstation. In the current study, the term “workstation’ could refer to a broader range of locations and equipment than in the IJmker study, which also may limit the reliability and validity of these questions. However, whilst descriptor of workstations included reference to laptops where appropriate, diagrams given within the questionnaire showed conventional desktop settings which may have biased responses. Validity and reliability of self-reported data on musculoskeletal exposures has been extensively reviewed (36, 37) with findings indicating that validity depends on study-specific factors, such as poor formulation of questions. Uncertainty of the validity and reliability of the questionnaire items relating to exposures in the current study therefore remains a limitation on the applicability of the findings. Future research may consider including some objective assessments of workstation and working postures, as well as extended demographic questions including private health insurance status. Specific questions may also focus on the impact, extent and duration of evolving technologies, such as tablets, smart phones and 'mobile' workstations. Prospective and longitudinal studies are also needed to investigate the impact of specific ergonomic interventions, as well as the impact of ergonomic training for specific populations.

6. Conclusion

The most commonly reported symptomatic areas were the neck and shoulder, followed by lower and upper back. Participants reporting poor seated postures (e.g. leaning forward, or sitting on the front edge of the chair) had increased odds of experiencing discomfort in the upper back. Few administrative staff and even fewer academics had attended Workstation Ergonomics Training or had requested individualised ergonomic assessments and these were not associated with having discomfort. These findings indicate that musculoskeletal discomfort is prevalent in workers in the university setting and this is associated with working postures. The high uptake of health services for musculoskeletal discomfort indicates a reliance on treatment, rather than prevention. The lack of Workstation Ergonomics Training and workstation assessment reported by university staff, coupled with the associations between ergonomics and discomfort, suggests that implementation of ergonomic interventions may be one strategy to address musculoskeletal discomfort in workers in university settings.

7. Acknowledgments

Thanks to The University of Newcastle Priority Research Centre for Physical Activity and Nutrition for supporting this work.

The researchers would like to thank IJmker et al (17), for giving permission to use parts of their survey.

This research is a collaborative work by the School of Health Sciences 'Healthy Work Healthy Life' research group.

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Highlights

- Musculoskeletal symptoms are commonly reported in a university setting.
- Academics use multiple workstations, not all configured ergonomically.

- Few university staff attended ergonomic training - an opportunity for intervention.
- Aspects of workstation configuration are associated with an increased risk of musculoskeletal symptoms