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Musculoskeletal disorders among nurses compared with two other occupational groups

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Background	There is a high incidence of low back pain (LBP) among nurses. However, few longitudinal studies have investigated musculoskeletal disorders (MSDs) at other anatomical sites in nurses.
Aims	To describe the cumulative incidence and persistence/recurrence of MSDs of the low back, neck, shoulder, elbow, wrist/hand and knee among New Zealand nurses, to investigate the impact of MSDs on work and functional tasks and to compare findings for nurses with those in postal workers and office workers.
Methods	Participants completed a postal survey at baseline and again 1 year later. Information was collected about MSDs in the previous 1 month and 12 months and about the ability to attend work, undertake work duties and perform functional tasks.
Results	Among nurses, the low back was the site with the highest cumulative incidence and highest prevalence of persistent/recurrent, work-disabling and functional-task-disabling pain. Work-disabling LBP was more prevalent among nurses and postal workers than office workers ($P < 0.001$). Nurses had a substantial prevalence of work-disabling shoulder pain (10%) and functional-task-disabling knee (19%) and wrist/hand pain (16%). With the exception of the elbow, each occupational group had a high prevalence of persistent/recurrent MSDs at all anatomical sites.
Conclusions	LBP continues to have a substantial impact among nurses. Other less commonly considered MSDs, such as shoulder, wrist/hand and knee pain, also made work or functional tasks difficult, suggesting that primary and secondary prevention efforts should consider MSDs at other anatomical sites as well as the low back.
Key words	Incidence; longitudinal studies; musculoskeletal pain; nurses; occupational disease; occupational exposure; office workers; pain; postal workers.

Introduction

Musculoskeletal disorders (MSDs) such as low back, neck and arm pain have a high prevalence worldwide [1] and are associated with burdens that affect individuals, employers and society [2]. Nurses are at high risk for MSDs [1], especially low back pain (LBP) [3]. In many countries, nursing is an occupation with a large workforce. The combination of high risk and a large workforce means the potential occupational impact of MSDs is significant. The majority of studies of MSDs among nurses have focused on LBP. However, a high prevalence of MSDs has also been noted for other body regions in previous cross-sectional reports [4–9]. Few longitudinal studies appear to have investigated MSDs at multiple anatomical sites in nurses. Furthermore, and as noted previously with regard to LBP in other populations [10], studies of MSDs among nurses sometimes report only a single measure of outcome (e.g. cumulative incidence). However, MSDs are dynamic and investigating multiple outcomes such

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as cumulative incidence and impact on participants in the same study may provide a more comprehensive picture of MSDs [10]. MSDs are also acknowledged to be multifactorial, with physical and workplace psychosocial factors having effects. It is, therefore, useful to compare nurses with other occupational groups. The longitudinal study reported in this paper investigates multiple MSD outcomes at multiple anatomical sites and compares the findings among nurses with those of two other occupational groups in New Zealand.

The aims of this study were to investigate (i) the 12 month cumulative incidence of MSDs, (ii) the 12 month prevalence of persistent or recurrent MSDs, (iii) the 12 month prevalence of work-disabling MSDs, (iv) the 1 month prevalence of MSDs affecting functional tasks at a range of anatomical sites, and (v) to compare these findings for nurses with those of postal workers and office workers.

Methods

This is the New Zealand arm of the international Cultural and Psychosocial Influences on Disability (CUPID) study, described elsewhere [11]. The CUPID study involved 18 countries, with the same types of workers (nurses, postal workers or manual workers using their upper limbs and office workers) recruited and completing the same core questionnaire in each country. The groups were chosen to be comparable internationally in terms of physical demands and to provide contrasts in terms of cultural and psychosocial environments [11], with the focus of the CUPID study being between country comparisons. Each country was able to add questions to the core set; for example, New Zealand additions related to this analysis included a question about modified work duties and additional characteristics such as physical activity and weight. In New Zealand, a postal survey was sent to nurses, postal workers and office workers in 2007 and again 1 year later. For inclusion in the study, participants had to be aged between 20 and 59, have been in their current job for at least 1 year and be resident in New Zealand at the time of the baseline survey. The study was approved by the New Zealand Multi-Region Ethics Committee.

In New Zealand, all nurses with an annual practising certificate are registered with the Nursing Council of New Zealand. At the time of the baseline survey, just >43 000 nurses held an annual practising certificate in New Zealand [12]. In 2007, nurses aged between 20 and 59 years and whose scope of practice was that of a registered nurse, nurse practitioner or enrolled nurse were randomly selected from the Nursing Council of New Zealand database and invited to participate in the study. Random selection and initial contact were carried out via the Nursing Council of New Zealand. Nurse assistants and those with a 'non-practice' code on the database were excluded. Postal workers, whose main role was mail sorting, were randomly selected from an employee database and office workers likely to be using computers were randomly selected from the 2005 New Zealand general electoral roll. Power calculations were based on a 1 month prevalence of MSDs lasting at least 7 days of 40% [13] and assumed a baseline response rate of 50%.

Potential participants were sent a study information sheet with an opt-out option available. Those not opting out were sent the postal survey. After 2 weeks, non-responders were sent another copy of the questionnaire and after 4 weeks they were telephoned. A similar survey was completed by participants 1 year later and the same follow-up of non-responders undertaken. For each completed survey, participants were sent a New Zealand $10 gift voucher.

Data were collected about MSDs present for at least 1 day involving the low back, neck, shoulder, elbow, wrist/hand and knee, over the previous 1 month and 12 months. Questions were based on the Nordic Musculoskeletal Questionnaire [14] and included a diagram of the anatomical site. Participants were asked if their MSD had involved either modified work duties or time off work over the past 12 months. Participants' ability to carry out specific functional tasks was assessed for the month prior to the survey. Participants were asked whether their MSD had 'made it difficult or impossible' to do particular activities, specific to the anatomical site involved, with response options: 'no', 'difficult' or 'impossible' (Table 1). Demographic questions included ethnicity, assessed using a question based on the New Zealand Census [15]. For analysis those reporting Samoan, Cook Island Maori, Tongan, Niuean or Fijian ethnicities were grouped into a 'Pacific' ethnicity category. Physical activity questions asked participants how many days they had carried out at least 30 minutes of moderate activity or 15 minutes of vigorous activity in the previous week [16].

The 12 month cumulative incidence was assessed for the subgroup of participants who were pain-free at the anatomical site for at least 1 month prior to the baseline survey. An incident MSD was defined as pain that was subsequently reported at the anatomical site in the

Table 1. Anatomical site-specific functional tasks

Anatomical site	Functional task
Each anatomical site	Getting dressed
	Household tasks
Low back	Cutting your toenails
Shoulder	Combing your hair
	Bathing/showering
Elbow	Opening bottles, jars or taps
Wrist/hand	Writing
	Locking and unlocking doors
	Opening bottles, jars or taps
Knee	Walking up and down stairs
	Walking on level ground

12 month interim between surveys. Persistent/recurrent MSDs for each anatomical site were assessed from the subgroup of participants reporting MSDs in the 12 months prior to the baseline survey. To be assessed as persistent/recurrent, the MSD had to be reported again in the 12 months prior to the follow-up survey. The term 'persistent/recurrent' was used because symptoms from the same MSD occurring continuously or episodically at the same anatomical site could not be distinguished. Work-disabling MSDs involved at least 1 day of either time off work or modified work duties during the 12 month follow-up. 'Functional-task-disabling' MSDs were those that made at least one functional task difficult or impossible in the month prior to the follow-up survey.

Initial analyses were carried out using Stata statistical software (version 9) [17]. Chi-squared tests determined differences between the groups for categorical data. Non-parametric tests (Kruskal–Wallis) were used for non-normally distributed continuous data. A *P*-value of <0.05 was considered statistically significant. Risk estimates for statistically significant exposures were provided by calculating the Mantel–Haenszel Common Odds Ratio Estimates using SPSS statistics version 20 [18].

Results

Of the 911 workers invited to participate in the study (280 nurses, 280 postal workers and 351 office workers), 12% were subsequently found to be ineligible and 4% (n = 34) were not at the contact address provided. Of the 770 potentially eligible participants remaining, the baseline participation rate was 58% (n = 443). One year later, the follow-up rate was 87% (n = 384). By occupational group, nurses had the highest participation rate at baseline (70%) followed by office workers (52%) and postal workers (50%). Office workers had the highest follow-up rate (93%), followed by nurses (88%) and postal workers (75%). Those who dropped out of the study were more likely to be of Māori or Pacific ethnicities, to have a history of smoking, to be younger and to have a slightly higher body mass index compared with those who completed the follow-up survey. Nurses were predominantly female and of New Zealand European ethnicity with a mean age of 44. Compared with nurses and office workers, postal workers were more likely to be male, of Māori or Pacific ethnicities, to be current smokers and to undertake physical activity between 5 and 7 days per week (Table 2). Among nurses, the anatomical site with the highest 12 month cumulative incidence of MSDs was the low back, followed by the neck, shoulder, wrist/hand and knee (Table 3). The proportions of persistent/recurrent MSDs were highest for low back and wrist/hand pain (76% each); however, the proportion of nurses reporting persistent/recurrent MSDs exceeded 60% for all MSDs apart from the elbow (45%). LBP had the highest prevalence of work-disabling and functional-task-disabling MSDs

Table 2. Baseline characteristics of workers who participated in the follow-up survey

Characteristic	Nurses, n = 160 n (%)	Postal workers, n = 87 n (%)	Office workers, n = 137 n (%)	P value
Sex				
Male	10 (6)	34 (39)	7 (5)	
Female	150 (94)	53 (61)	130 (95)	<0.001
Ethnicity				
NZ European	118 (74)	48 (55)	111 (81)	
Māori	12 (8)	18 (21)	11 (8)	
Pacific	4 (3)	11 (13)	3 (2)	
Other	26 (16)	8 (9)	12 (9)	<0.001
Smoking status				
Currently smoking (yes)	19 (12)	23 (26)	20 (15)	<0.05
Ever smoked (yes)	67 (42)	39 (45)	61 (45)	NS
Physical exercise				
0 days/week	20 (13)	13 (15)	22 (16)	
1–4 days/week	79 (50)	29 (33)	75 (55)	
5–7 days/week	59 (37)	41 (47)	40 (29)	<0.05
Age (years)				
Mean	44	43	46	NS
Standard deviation	9	12	9	
Body mass index (kg/m^2)				
Mean	27	27	26	
Standard deviation	7	6	7	NS

NS, not significant.

Table 3. Musculoskeletal disorders of the low back, neck, shoulder, elbow, wrist/hand and knee: incidence, persistence/recurrence and impact on work and functional tasks

Musculoskeletal disorders	Incidence *n*/*N* (%)	Persistence/ recurrence *n*/*N* (%)	Work-disabling (12 months) *n*/*N* (%)	Functional-task disabling (1 month) *n*/*N* (%)
LBP				
Nurses	35/100 (35)	70/92 (76)	31/158 (20)	32/158 (20)
Postal workers	19/61 (31)	33/46 (72)	15/85 (18)	13/83 (16)
Office workers	24/101 (24)	37/61 (61)	6/135 (4)	15/137 (11)
P value*	NS	NS	<0.001	NS
Neck				
Nurses	37/118 (31)	51/80 (64)	11/159 (7)	15/159 (9)
Postal workers	19/59 (32)	26/43 (60)	10/85 (11)	7/85 (8)
Office workers	20/90 (22)	47/69 (68)	12/135 (9)	11/137 (8)
P value	NS	NS	NS	NS
Shoulder				
Nurses	31/123 (25)	37/61 (61)	16/159 (10)	22/159 (14)
Postal workers	18/56 (32)	26/42 (62)	15/84 (17)	18/87 (21)
Office workers	20/100 (20)	32/51 (63)	6/136 (4)	18/36 (13)
P value	NS	NS	<0.01	NS
Elbow				
Nurses	16/145 (11)	10/22 (45)	7/158 (4)	7/157 (4)
Postal workers	7/71 (10)	13/27 (48)	5/87 (6)	6/87 (7)
Office workers	13/117 (11)	9/28 (32)	2/136 (1)	6/137 (4)
P value	NS	NS	NS	NS
Wrist/hand				
Nurses	23/129 (18)	29/38 (76)	11/158 (7)	25/158 (16)
Postal workers	23/54 (43)	32/44 (73)	16/87 (18)	23/86 (26)
Office workers	18/106 (17)	31/46 (67)	5/137 (4)	22/136 (16)
P value	<0.001	NS	<0.001	NS
Knee				
Nurses	20/117 (17)	35/53 (66)	7/157 (4)	29/156 (19)
Postal workers	11/61 (18)	19/29 (66)	5/87 (6)	13/85 (15)
Office workers	16/116 (14)	17/28 (61)	4/136 (3)	13/136 (10)
P value	NS	NS	NS	NS

NS, not significant.
n is the number of participants with the characteristic; *N* is the available denominator; work-disabling musculoskeletal disorders were those that involved either time off work or modified duties for at least 1 day over the previous 12 months; functional task disabling musculoskeletal disorders were those that made at least one (specified) functional task 'difficult' or 'impossible' over the previous month.
**P*-values calculated using chi-square tests.

(20%). However, the 1 month prevalence of functional-task-disabling knee pain (19%) was similar to LBP and was followed by wrist/hand pain (16%). Work-disabling shoulder pain was reported by 10% of nurses in the 12 months of follow-up (Table 3).

When nurses were compared with postal workers and office workers, statistically significant differences were observed for work-disabling low back and shoulder pain, and cumulative incidence, work-disabling and functional-task-disabling wrist/hand pain. Nurses had the highest prevalence of work-disabling and functional-task-disabling LBP, but this did not reach statistical significance for functional-task-disabling LBP. Compared with office workers, work-disabling LBP showed a prevalence odds ratio (OR) of 4.6, 95% confidence interval (95% CI) 1.7–12.4, for postal workers and 5.3, 95% CI 2.1–13.0 for nurses. Work-disabling shoulder pain in nurses (10%) was higher than in office workers (4%; although this did not reach statistical significance) but not as high as in postal workers (17%); (OR 2.4, 95% CI 0.9–6.4 for nurses compared with office workers and 4.7, 95% CI 1.8–12.7 for postal workers compared with office workers). Postal workers had the highest cumulative incidence, work-disabling and functional-task-disabling wrist/hand pain. Comparing postal workers with office workers gave an OR of 3.4, 95% CI 1.7–6.9 for cumulative incidence of wrist/hand pain and 6.0, 95% CI 2.1–16.9 for work-disabling wrist/hand pain. Functional-task-disabling knee pain was highest in nurses compared with the other two occupational groups, but this did not reach statistical significance.

Discussion

The main finding of this study was that MSDs at a range of anatomical sites had a high incidence, persistence/recurrence and impact on work and/or functional tasks among nurses. Comparing the occupational groups differences in cumulative incidence and the prevalence of persistent/recurrent MSDs were not statistically significantly different with the exception of a higher cumulative incidence of wrist/hand pain among postal workers. The prevalence of persistent/recurrent MSDs was consistently high. However, depending on the effect of the MSDs, the cumulative incidence and persistence/recurrence may be less important than conditions that interfere with work and functional tasks. The impact of LBP on work and functional tasks among nurses was substantial (20%) with work-disabling LBP being significantly higher among both nurses and postal workers than office workers. Work-disabling shoulder and wrist/hand pain were significantly more prevalent among postal workers compared with office workers. Among nurses low back, knee, wrist/hand and shoulder pain had the greatest impact on functional tasks.

The strengths of this study include the longitudinal design, assessment of multiple outcomes and inclusion of a range of anatomical sites. For a postal survey, we had a good baseline participation rate (58%) but unfortunately did not have information about non-responders so may have overestimated prevalence at baseline (reported elsewhere as part of a cross-sectional analysis [19]). The study had a high follow-up rate (87%). However, MSDs were self-reported and not confirmed by clinical diagnosis and recall bias may have affected the results. In 2008 in New Zealand, >5000 nurses (13%) were aged >60 [20]. Depending on the effect of age, it may not be valid to generalize the results to this age group. There may be some misclassification, for example cumulative incidence may have captured new episodes of previously existing MSDs as well as new MSDs. Persistent/recurrent MSDs may have included single episode MSDs of short duration, but spanning the time the baseline survey was completed, and therefore present in both 12 month assessment periods. Another limitation is the sample size, which may have limited the statistically significant differences seen between occupational groups. There is also a range of nursing roles, and the specific incidence and prevalence of MSDs may vary for different types of nursing positions.

The cumulative incidence of LBP among nurses (35%) was comparable with studies of nurses in the UK (38%) [21] and Hong Kong (39%) [22], although in Hong Kong incidence eligibility required being free of LBP for a year. The prevalence of work-disabling LBP among nurses was comparable with previous studies of nurses in Greece (17%) [23], although in Greece this did not include modified work duties. The findings for persistent/recurrent LBP among nurses (76%) are comparable with a previous systematic review where 73% of people with acute LBP had a recurrence >12 months [24], but higher than another systematic review, which found that among people with LBP on average 62% still had LBP 12 months later [25]. This was, however, comparable with persistent/recurrent LBP among our office workers (61%).

A previous systematic review of workers [26] also found that rates of persistent or recurrent neck pain were high after 12 months (60–80%). The cumulative incidence of neck pain (31%) among nurses was similar to that in a study of nurses in the UK (34%) [27]. The prevalence of work-disabling shoulder pain among nurses was higher than previously reported in nurses in Greece (5%) [23], albeit not including modified work duties.

These findings confirm the importance of LBP as an area of focus for nurses. It suggests that an emphasis on both primary and secondary prevention of LBP in nurses is still required, despite LBP among nurses being highlighted as a problem >20 years ago [28]. Also important is the relatively high prevalence of work-disabling low back and shoulder pain in nurses and postal workers and wrist/hand pain among postal workers. Both these occupational groups are known to carry out physical tasks so despite having a similar underlying prevalence of persistent/recurrent pain, it is not surprising that there would be more work disability than among office workers. Other MSDs such as wrist/hand and knee pain had less effect on work but a high proportion of functional task disablement in all occupational groups. This may indicate the greater anatomical site specificity of the questions asked about functional tasks compared with the broader definition of the impact on work, and that the impact on work is also likely to be affected by other factors such as the type of work involved. It is also possible that recall bias affected the results with a higher prevalence for functional-task-disabling MSDs, assessed over a 1 month period, compared with the 12 month period for work-disabling MSDs. This may have meant work-disabling MSDs were under-estimated. However, recall bias aside, it indicates that these workers are likely to be working while they have MSDs that are having a considerable impact on basic functional tasks. Working is acknowledged as beneficial [29]; however, it is possible that MSDs are having an impact on work in ways not assessed in this study; workers may for example be in pain while undertaking tasks. A study of New Zealand nurses, albeit focused on back pain, noted that 40% of those with back pain reported that the speed at which they were able to undertake tasks was affected by their pain [30].

The findings of this study suggest that primary and secondary prevention issues should have a broad focus

with regard to the anatomical site of MSDs among nurses. Future research should include MSDs at multiple anatomical sites while not losing sight of the continued impact of LBP in these workers.

Key points

- This study confirms the importance of the prevention and management of low back pain among nurses but indicates that other anatomical sites also warrant attention in these workers.
- Low back had the highest cumulative incidence, persistence/recurrence and impact on work and functional tasks among nurse, but shoulder, wrist/hand and knee pain also had a substantial impact on work and/or functional tasks.
- There was a high rate of persistence/recurrence of musculoskeletal disorders among all occupational groups.

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Conflicts of interest

None declared.

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