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Original Article

Occupational Risk Factors for Upper-limb and Neck Musculoskeletal Disorder among Health-care Staff in Nursing Homes for the Elderly in France

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Abstract: This study investigated the relation between working conditions, in terms of physical and psychological demand, and upper-limb and neck musculoskeletal disorders (ULNMD) in female staff working in direct contact with the elderly in nursing homes. A cross-sectional survey was conducted in 105 nursing homes in France. Data on nursing-home working conditions were collected by questionnaire from occupational physicians and by self-administered questionnaire from staff. Psychosocial demand at work was assessed on Siegrist's questionnaire and ULNMD on the Nordic questionnaire. 2,328 employees were included: 628 housekeepers, 1,372 nursing assistants and 328 nurses. During the previous 12 months, 50% of the subjects (1,160) had presented with a musculoskeletal complaint concerning the neck, 38% (881) the shoulders, 10% (246) the elbows and 22% (520) the wrists. 9% (219) reported effort/reward imbalance on the 2004 Siegrist questionnaire and 42% were in a situation of over-commitment. ULNMD complaints were associated not only with physical occupational factors but also with psychosocial factors (effort/reward imbalance and over-commitment), both before and after adjustment on individual and occupational factors. Prospective studies are needed to clarify the causal role of occupational, including, organizational, psychosocial factors in ULNMD outcomes. Preventive approaches should take account of both physical and psychosocial occupational factors.

Key words: Female nursing-home staff, Upper-limb and neck musculoskeletal disorder, Occupational psychosocial factors, Nurses working conditions

Introduction

An epidemiological surveillance system for work-related musculoskeletal disorders (MSDs) implemented in 2002 in France's Pays de la Loire region found 11% prevalence in men and 15% in women for clinically diagnosed

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upper-limb MSD[1]. Upper-limb and neck MSD (ULNMD) is a common cause of morbidity, and in some occupational groups contributes significantly to time off work[2, 3], with approximately 5.5 million working days lost annually in the United Kingdom[4]. There is substantial evidence to suggest that ULNMD is a significant problem within the European Union.

ULNMD is frequently attributed to work, and is considered work-related when occupational activities and conditions significantly contribute to onset or exacerbation[4]. Many studies and systematic reviews have shown that physical demand (e.g., sustained abnormal posture, abnormal force, vibration, rapid repetitive movement and computer use) may be associated with upper-limb disorder. Psychosocial and cultural factors are also involved[5, 6].

Many studies have highlighted gender differences in upper-limb MSD in the working population and much of the research on care points to female predominance[7, 8] in 2005 in France, 87.1% of nurses, 90.3% of nursing assistants and 79.8% of hospital cleaning staff were women[8, 9].

Medical retirement homes provide collective accommodation and count as "establishments for the accommodation of dependent elderly persons" (*Etablissements d'Hébergement pour Personnes Agées Dépendantes*: EHPAD). They provide overall management for the elderly, including lodging, healthcare and aid with dependence.

Residential facilities for the elderly are admitting increasing numbers of patients with multiple pathologies, including neuropsychiatric disorder, due to the low capacity of hospital geriatric departments[10]. Thus, the increase in the number of dependent elderly persons and the evolution of their way of life will, by 2020, entail increased demand for professional care-workers in both home and residential long term care settings[11].

Geriatric nursing has been found to be both physically (e.g., lifting and carrying, work schedule) and mentally demanding, though, rewarding in many respects[12]. Healthcare professionals in nursing homes are subject to strong mental and physical demand, and frequently describe their working environment as hostile[13, 14].

To our knowledge, very few studies have focused on the relationship between working conditions and ULNMD in staff of nursing-homes for the elderly[10, 15–17].

The aim of the study was, to describe the frequency of each joint of ULNMD and to assess the relation between working conditions in terms of physical and psychosocial demand and musculoskeletal disorders assessed by Nordic questionnaire, in female staff working in direct contact with elderly persons in nursing homes.

Subjects and Methods

Design

The study was designed as a cross-sectional survey using a questionnaire.

Sample

The target population of the survey was employees working with elderly patients in nursing homes in the Rhône-Alpes Region of France. The Region has a population of over 6 million (10% of the population of France). In 2009 in the Rhône-Alpes Region, 644 occupational physicians (full-time equivalent) were providing medical follow-up for 1,707 million employees[18]; nursing homes and other private medical social centers employed 10,000 staff in 677 nursing homes for the elderly[19].

In nursing homes, management is founded on a qualified multidisciplinary team notably comprising nurses, nursing assistants and housekeepers. Nurses ensure technical care and coordinate the work of the nursing assistants. As well as catering and accompaniment, nursing assistants are in charge of hygiene, comfort and preventive and curative care, under the supervision of a nurse. Nursing assistants include nursing auxiliaries, medical and psychological assistants and social assistants. Housekeepers carry out cleaning tasks, catering tasks and sometimes care tasks such as help with meals.

The occupational physician is the prime go-between for the staff and the institution, collecting information on employee health status and working conditions. The occupational physicians of the Region were asked to participate in the survey by the Regional Department of Businesses, Competition, Consumption, Work and Employment (DIRECCTE), a state business consultancy advice and interventions for businesses. Volunteer occupational physicians could include the employees of only 1 or 2 of the nursing homes they oversaw. If they were involved in several establishments, only 2 study centers were randomly selected, so as not to overload them to the detriment of data harvesting quality.

The occupational physician collected data on working conditions in nursing homes, such as "type of nursing homes", "number of beds for residents", "ratio of staff to residents" and "residents' mean dependence level per nursing home", by completing a questionnaire. The number of beds for residents represents the institution's reception capacity; the staff-to-residents ratio was calculated as the number of full-time equivalent staff positions as a function of beds occupied.

The occupational physician asked all employees meeting the inclusion criteria in the nursing homes which they oversaw to take part.

New recruits were excluded, so as to avoid attributing to the nursing home problems that had more to do with a previous job. Only employees who had been working with the elderly for at least 12 months on at least a half-time basis were included in the analysis. The study population was limited to female staff working in direct contact with the elderly.

The occupational physician and team distributed the self-administered questionnaire to staff.

The questionnaire was not allowed to be sent back late to the occupational physician, so as to avoid differences in data collection.

Data collection

Between October 2009 and September 2010, volunteer employees' socio-occupational data were collected by self-administered questionnaires and were returned to occupational physician.

The questionnaire covered the following items:

Personal characteristics: age, gender, family status, number of children, number of dependent children (i.e., children living in the family home), lifestyle, job title, and relevant professional qualifications.

Medical characteristics: musculoskeletal complaints according to anatomic site, general health status, body mass index (BMI), and smoking status. Subjects no longer smoking at the time of the survey were counted as "ex-smokers", those still smoking as "smokers", and those who had never smoked as "non-smokers". BMI categories (weight (kg)/ [height (m)]^2) were determined according to WHO guidelines (BMI <18.5, underweight; 18.5–24.99, normal; 25–29.99, overweight; ≥ 30, obese) [20].

Work-related characteristics:

Occupational characteristics: job title, seniority in the establishment with years of experience, duration of experience of working with the elderly, care-staff to residents ratio in the nursing home, type of nursing home. Occupational status distinguished between long-term (titular or other) and short-term (internship, temporary or other) contracts. Educational level was divided into 4 classes: 3 yr' higher education; school-leaving certificate to 2 yr' higher education (after school-leaving certificate); vocational training certificate; and no certificate.

Physical exposure: part/full-time contract, schedule, night shifts, working day, number of washings carried out alone, number of beds made alone, use of adjustable height beds, handling training during the previous 5 years,, number of beds, residents' level of dependence.

Psychosocial exposure: Siegrist questionnaire[21].

Measures

Quantitative seniority was transformed into an ordinal qualitative variable for statistical purposes. Visual analog health scales were used to describe general health status (0: very poor health, 10: very good health). General health status was classified as "poor/very poor health" (0 to 2), "moderate heath" (3 to 5), or "good/very good health" (6 to 10).

Work-related psychosocial demand and social support were assessed on the Siegrist questionnaire, comprising 3 scales: 2 measuring the extrinsic components of 'effort' (6 items) and 'reward' (11 items covering earnings, esteem and job security) and 1 measuring the intrinsic component of 'over-commitment' (6 items)[21, 22]. Effort was measured either by 6 items on the demanding aspect of the work environment (3 measuring quantitative load, 1 qualitative load, 1 increase in total load over time, and 1 physical load), rated as (1) does not apply, (2) does apply but subject does not consider her/himself distressed; (3) does apply and subject considers her/himself somewhat distressed, (4) does apply and subject considers her/himself distressed, or (5) does apply and subject considers her/himself very distressed. A sum score of these ratings was constructed, as documented in several studies[21, 22]. According to the effort-reward imbalance model, extrinsic and intrinsic effort scores are directly proportional to effort, whereas the rewards score is inversely proportional to reward. Effort-reward imbalance (ERI) was measured by calculating the ratio between the extrinsic effort index (E) and the inverse reward index (R): E/ (R*c), with c as a correction factor (c: 6/11); ERI >1 indicates a critical condition of high-cost/low-gain, or effort-reward imbalance[21, 22].

The higher the intrinsic effort score, the greater the effort. Over-commitment was defined by an intrinsic effort score greater than the upper tercile.

ULNMD was assessed on the Nordic questionnaire, comprising multiple choice questions for each body part (During the last 12 months: have you had trouble (such as ache, pain, discomfort)? Have you been prevented from working because of this trouble? Have you seen a physician for this condition? Did you need to take medication for this symptom?). Nordic questionnaires exploring symptoms in the past year have been shown to be useful tools for the surveillance of upper-limb work-related musculoskeletal disorders (UWMSD)[23].

Table 1. Socio-demographics, medical and occupational items

N=2,328							
	Socio-demographics items			Medical items			
	variables	n	%	variables		n	%
Family situation	Single	418	18.1	Smoking	Non-smoker	1,113	48.4
	In couple	1,527	66.0		Ex-smoker	284	12.4
	Separated, divorced or widowed	368	15.9		smoker	901	39.2
Children	≥1 dependent children	1,375	59.1	General health status	Poor/very poor	160	6.9
	No dependent children	413	17.8		Moderate	1,184	51.1
	No children	538	23.1		Good/very good	972	42.0
Age	<30 yr	464	19.9	ULNMD location	Neck	1,160	50.6
	30–39 yr	490	21.1		Shoulder	881	38.6
	40–49 yr	749	32.2		Elbow	246	10.9
	≥50 yr	623	26.8		Wrist	520	22.9
Educational level	≥3 yr' HE	324	20.1	BMI	<18.5	111	5.00
	2 yr' HE-SLC	89	5.5		18.5–24.99	1,241	55.7
	Vocational certificate	1,079	66.9		25–29.99	562	25.3
	No certificate	120	7.5		≥30	312	14.0
				Occupational items			
Contract	Permanent	1,799	78.0	Number of beds made alone	<5	926	43.7
	Temporary	509	22.0		[5–10[	576	27.2
					≥10	617	29.1
Occupational group	Housekeepers	628	27.0	Training in handling in previous 5 yr	No	1,018	43.7
	Nursing assistants	1,372	58.9		Yes	1,310	56.3
	Nurses	328	14.1				
Full/part time work	Part-time	633	27.4	Seniority in the establishment (years of experience)	≤1 yr	555	24.2
	Full-time	1,678	72.6		2–4 yr	529	23.1
					5–10 yr	523	22.8
					>10 yr	687	29.9
Schedule	Fixed-schedule daytime work	523	22.8	Experience of work with elderly persons	1–4 yr	705	30.3
					5–9 yr	612	26.3
	other	1,775	77.2		10–19 yr	655	28.1
					>20 yr	356	15.3
Night- shifts	No	1,968	84.5	Ratio of staff to residents	[0–0.42[“;	678	29.1
	Yes	360	15.5		[0.42–0.50[;	476	20.5
					[0.50–0.60[.	527	22.6
					≥0.60	647	27.8
Working hours	≤7 h	282	17.4	Number of beds	≤69	588	25.2
	[7–9[;	392	24.3		[70–89]	766	32.9
	[9–11[	476	29.5		[90–99]	318	13.7
	>11 h	465	28.8		≥100	656	28.2
Number of washings performed alone	<5	733	36.8	Over-commitment	No	1,309	57.1
	[5–10[.	776	37.0		Yes	985	42.9
	≥10	551	26.2				
Type of home	Private	499	21.4	Effort/reward imbalance	No	2,083	90.5
	Non-profit	738	31.7		Yes	219	9.5
	Public-sector	912	39.2				
	Other	179	7.7				
Use of adjustable height beds	Sometimes/never	267	11.8				
	Always/often	1,996	88.2				

HE: higher education; SLC: school leaving certificate (*Baccalauréat*)

Ethical considerations

Approval by the French Ministry of Health Research (*Comité Consultatif pour le Traitement de l 'Information en Matière de Recherche dans le Domaine de la Santé*) was obtained before starting the study. Employees were free to agree or decline to participate. They were given an information leaflet explaining the study objectives.

Data analysis

A descriptive step characterized the population of

Table 2. ULNMD and occupational and medical impacts

	Complaints during the previous 12 months							
	Neck (n=1,160)		Shoulder (n=881)		Elbow (n=246)		Wrist (n=520)	
	n/N	%	n/N	%	n/N	%	n/N	%
Impact on work	770/1,128	68.3	673/852	79.0	193/237	81.4	409/504	81.1
Medical treatment (including self-medication)	598/1,131	52.9	516/842	61.3	154/236	65.2	260/497	52.3
Medical diagnosis	473/1,118	42.3	413/836	49.4	124/231	53.7	207/493	42.0

employees according to training, work organization and working conditions.

Associations were sought between ULNMD and personal factors such as age, family situation and educational level, and occupational factors such as full/part-time contract, factors relating to physical burden, psychosocial factors and institutional factors.

Frequencies were compared on χ^2 tests, with χ^2 trend tests depending on the results of cross-analysis. Mean values were compared between pairs of groups on the Student test and between more than 2 groups by analysis of variance (ANOVA).

Ratios of event probabilities per musculoskeletal complaint were studied. As the prevalence of each event was high, odds ratios would not provide a good estimate of prevalence ratio[24]: rather, the log-linked binomial model was applied using the PROC GENMOD procedure in the SAS statistical package (version 9.3) with the DIST=BINOMIAL and LINK=LOG options. In case of non-convergence of PROC GENMOD because the maximum likelihood estimate (MLE) lay on the boundary of the parameter space, the SAS COPY macro was used[25], which provides a good approximation to the exact maximum likelihood estimates, as well as yielding good estimates of the true population parameters.

The binary response of each musculoskeletal complaint was modeled in two steps.

First, all independent variables underwent univariate analysis. Secondly, variables with a p-value$\leq$0.1 were included in a multivariate model by a step-forward procedure: the variable with the lowest p-value was included in the model first, followed by the next lowest, and so on. Variables with p-values<0.05 remained in the model, and the other variables were excluded.

Results

Descriptive analyses

Socio-occupational and medical data (Tables 1 and 2)

78 volunteer occupational physicians agreed to participate in the survey. Five nursing-home managers refused staff participation; 6 occupational physicians who were initially willing finally decided not to take part.

2,328 women working in direct contact with the elderly in 105 nursing homes were included. 47 subjects refused to participate, leading to a participation rate of 98%. The mean age of non-respondents was 44.4 yr (standard deviation=12.24); 27.7% (13) had between 1 and 4 yr' experience of work with elderly persons, 21.3% (10) between 5 and 9 yr, 31.9% (15) between 10 and 19 yr and 19.1% (9) more than 19 yr. The most frequent grounds for non-participation were lack of time and/or interest in the survey.

Two-thirds of respondents were living in couples. More than half were aged over 40 yr. Two-thirds (1,199) had an educational level lower than the school-leaving certificate (*baccalauréat*). Three-quarters had permanent work contracts; 27.4% (633) were working part time. Only 22.8% (523) were working a fixed daytime schedule. Half (1,210) had at least 5 yr' seniority in their nursing home and more than two-thirds (1,623) had more than 5 yr' experience of work with the elderly. 9.5% (219) showed effort/reward imbalance on the Siegrist 2004 questionnaire.

Half (1,160) reported complaints during the previous 12 months concerning the neck, 38.1% (881) the shoulders, 10.9% (246) the elbows and 22.9% (520) the wrists. More than two-thirds of these musculoskeletal complaints, regardless of location, impacted work. Neck and wrist disorders less frequently required treatment and were less frequently specifically diagnosed.

Univariate analysis (Tables 3 and 4)

Personal and occupational factors were sought for ULNMD.

Cervical region complaints

BMI and smoking were the personal factors associated with neck complaints.

Table 3. Relations between non-work-related personal factors and musculoskeletal complaints

		ULNMD location							
		Neck (n=1,160)		Shoulder (n=881)		Elbow (n=246)		Wrist (n=520)	
		n (%)	PR [95% CI]	n (%)	PR [95% CI]	n (%)	PR [95% CI]	n (%)	PR [95% CI]
Family situation	Single	203 (49.0)	1	140 (33.8)	1*	28 (6.8)	1**	186 (20.9)	1
	In couple	766 (51.0)	1.04 [0.93–1.16]	576 (38.6)	1.14 [0.98–1.32]	168 (11.3)	1.66 [1.133–2.44]	338 (22.7)	1.09 [0.89–1.34]
	Separated, divorced or widowed	182 (50.1)	1.02 [0.89–1.18]	157 (43.5)	1.29 [1.07–1.34]	49 (13.7)	2.01 [1.29–3.13]	93 (26.1)	1.25 [0.97–1.62]
Children	No children	271 (50.9)	1	182 (34.2)	1**	24 (4.5)	1****	114 (21.5)	1*
	No dependent children	216 (53.2)	1.04 [0.92–1.18]	183 (46.0)	1.34 [1.15–1.58]	71 (18.0)	3.97 [2.55–6.19]	110 (27.8)	1.30 [1.03–1.63]
	≥1 dependent child	671 (49.6)	0.97 [0.88–1.07]	514 (38.1)	1.11 [0.97–1.27]	151 (11.3)	2.49 [1.64–3.79]	295 (22.0)	1.30 [1.03–1.63]
BMI	<18.5	57 (51.3)	1*	34 (30.9)	1*	9 (8.3)	1	24 (22.0)	1
	18.5–24.99	653 (53.3)	0.96 [0.80–1.16]	45 (37.0)	0.84 [0.63–1.11]	122 (10.1)	0.82 [0.43–1.56]	268 (22.2)	0.99 [0.68–1.43]
	25–29.99	260 (47.4)	0.89 [0.80–0.99]	228 (41.9)	1.13 [1.00–1.28]	72 (13.3)	1.31 [0.99–1.72]	142 (26.0)	1.17 [0.98–1.39]
	≥30	136 (44.0)	0.83 [0.72–0.95]	132 (42.9)	1.16 [0.99–1.35]	29 (9.5)	0.94 [0.64–1.38]	67 (21.8)	0.98 [0.78–1.24]
Smoking	Non-smoker	513 (46.9)	1**	414 (38.0)	1	114 (10.6)	1	254 (23.5)	1
	Ex-smoker	158 (56.2)	1.19 [1.06–1.35]	119 (42.5)	1.12 [0.96–1.31]	37 (13.3)	1.26 [0.89–1.78]	67 (24.1)	1.02 [0.81–1.29]
	Smoker	477 (53.5)	1.14 [1.05–1.25]	327 (38.0)	0.99 [0.89–1.12]	92 (10.4)	0.99 [0.76–1.28]	193 (21.9)	0.93 [0.79–1.09]
Age	<30 yr	217 (46.8)	1	121 (26.2)	1****	21 (4.5)	1****	102 (22.0)	1*
	30–39 yr	254 (52.3)	1.12 [0.98–1.27]	168 (34.8)	1.33 [1.09–1.62]	23 (4.8)	1.05 [0.59–1.87]	100 (20.7)	0.94 [0.74–1.21]
	40–49 yr	388 (52.4)	1.12 [0.99–1.26]	296 (40.4)	1.54 [1.29–1.84]	104 (14.3	3.14 [1.99–4.94]	152 (20.9)	0.95 [0.76–1.19]
	≥50 yr	300 (49.8)	1.06 [0.94–1.21]	295 (48.9)	1.87 [1.57–2.22]	98 (16.7)	3.66 [2.32–5.78]	164 (27.7)	1.26 [1.02–1.56]
Educational level	≥3 yr' HE	174 (54.2)	0.99 [0.76–1.29]	119 (37.1)	1.11 [0.80–1.55]	32 (10.1)	2.75 [1.16–6.49]	45 (14.2)	0.69 [0.43–1.14]
	2 yr' HE – SLC	46 (52.3)	1	29 (33.3)	1	6 (6.9)	1	18 (20.4)	1
	Vocational certificate	543 (51.0)	1.04 [0.83–1.30]	440 (41.6)	1.25 [0.92–1.69]	114 (10.8)	1.47 [0.63–3.40]	261 (24.8)	1.21 [0.79–1.85]
	No certificate	61 (51.7)	1.04 [0.83–1.30]	49 (42.6)	1.28 [0.89–1.84]	22 (19.0)	1.57 [0.71–3.47]	35 (29.9)	1.46 [0.89–2.40]

HE: higher education; SLC: school leaving certificate (*Baccalauréat*). Prevalence Ratio (PR), Confidence Interval (CI). *p* significant * $p<0.05$;** $p<0.01$; *** $p<0.001$;**** $p\leq10^{-4}$

Job, schedule, daily work time, number of washings performed alone, seniority in the nursing home, experience of work with the elderly, over-commitment and effort/reward imbalance, were the occupational factors associated with cervical region complaints.

But full/part-time work, night-shifts, number of beds made alone, use of adjustable-height beds, ratio of staff to residents, number of beds, type of home and residents' mean dependence level were not associated with cervical complaints.

Shoulder complaints

Age, family situation, number of dependent children and BMI were the personal factors associated with shoulder complaints.

Type of job contract, job, night-shifts, daily work time, number of washings performed alone, seniority in the nursing home, experience of work with the elderly, over-commitment and effort/reward imbalance, were the occupational factors associated with shoulder complaints.

Full/part-time work, schedule, number of beds made alone, use of adjustable-height beds, training in handling in previous 5 yr, ratio of staff to residents, number of beds, type of home and residents' mean dependence level were not associated with shoulder complaints.

Elbow complaints

Age, family situation, number of dependent children and educational level were the personal factors associated with elbow complaints.

Type of job contract, seniority in the nursing home, experience of work with the elderly, number of beds in the nursing home, over-commitment and effort/reward imbalance, were the occupational factors associated with elbow complaints.

Full/part-time work, schedule, night-shifts, working hours, number of washings performed alone, number of beds made alone, use of adjustable-height beds, training in handling in previous 5 yr, ratio of staff to residents, number of beds, type of home and residents' mean dependence level were not associated with elbow complaints.

Table 4. Relations between work-related personal factors and musculoskeletal complaints

		ULNMD location							
		Neck (n=1,160)		Shoulder (n=881)		Elbow (n=246)		Wrist (n=520)	
		n (%)	PR [95% CI]	n (%)	PR [95% CI]	n (%)	PR [95% CI]	n (%)	PR [95% CI]
Contract	Permanent contract	238 (47.1)	1	723 (41.1)	1***	30 (6.0)	1****	424 (24.3)	1**
	Temporary contract	912 (51.5)	0.9 [0.82–1.01]	151 (30.1)	0.73 [0.64–0.85]	215 (12.3)	0.48 [0.33–0.70]	93 (18.5)	0.76 [0.62–0.93]
Occupational group	Housekeepers	281 (45.7)	1*	210 (34.5)	1*	752 (12.4)	1	137 (22.8)	1****
	Nursing Assistants	708 (52.3)	1.14 [1.04–1.26]	552 (40.8)	1.18 [1.04–1.34]	141 (10.5)	0.85 [0.65–1.10]	388 (25.1)	1.10 [0.92–1.31]
	Nurses	171 (52.6)	1.15 [1.00–1.32]	120 (36.9)	1.07 [0.89–1.28]	30 (9.4)	0.75 [0.50–1.12]	45 (14.1)	0.62 [0.45–0.84]
Full/part-time work	Part-time	850 (51.4)	0.94 [0.86–1.04]	231 (37.3)	0.95 [0.84–1.07]	63 (10.3)	0.93 [0.71–1.22]	127 (20.6)	0.86 [0.72–1.03]
	Full-time	302 (48.5)	1	647 (39.3)	1	180 (11.0)	1.	390 (23.8)	1
Schedule	Fixed-schedule daytime work	234 (45.8)	1*	194 (38.3)	1	52 (10.3)	1	123 (24.4)	1
	Other	909 (51.8)	1.13 [1.02–1.26]	675 (38.7)	1.00 [0.89–1.14]	194 (11.2)	1.09 [0.81–1.45]	391 (22.5)	0.92 [0.77–1.10]
Night-shifts	No	986 (50.8)	1	761 (39.5)	1*	205 (10.7)	1	442 (23.1)	1
	Yes	174 (49.3)	0.97 [0.86–1.09]	120 (33.7)	0.85 [0.73–0.99]	41 (11.7)	1.09 [0.79–1.50]	78 (22.2)	0.96 [0.78–1.19]
Working hours	≤7 h	128 (46.2)	1*	97 (35.3)	1*	28 (10.3)	1	72 (26.1)	1**
	[7–9]	200 (51.8)	1.12 [0.96–1.31)	149 (39.0)	0.90 [0.74–1.11]	37 (9.7)	1.06 [0.66–1.69]	62 (16.2)	1.65 [1.20–2.20]
	[9–11]	224 (48.0)	1.04 [0.89–1.22]	158 (33.8)	0.86 [0.72–1.03]	57 (12.3)	1.27 [0.86–1.88]	107 (23.1)	1.42 [1.07–1.89]
	>11 h	256 (55.8)	1.21 [1.04–1.40]	193 (42.5)	1.09 [0.92–1.28]	45 (10.0)	1.04 [0.69–1.57]	115 (25.4)	1.56 [1.19–2.07]
Number of washings performed alone	<5	360 (47.1)	1*	263 (34.6)	1*	84 (11.1)	1	146 (19.3)	1***
	[5–10]	402 (52.5)	1.12 [1.00–1.24]	306 (40.2)	1.16 [1.02–1.33]	75 (0.9)	0.89 [0.66–1.20]	177 (23.3)	1.21 [0.99–1.47]
	≥10	296 (54.2)	1.15 [1.03–1.28]	223 (41.2)	1.19 [1.04–1.37]	62 (11.5	1.04 [0.76–1.42]	155 (28.7)	1.48 [1.22–1.81]
Number of beds made alone	<5	463 (50.5)	1	337 (36.8)	1	96 (10.5)	1	177 (19.5)	1**
	[5–10]	278 (49.1)	0.98 [0.88–1.08]	217 (38.4)	1.04 [0.91–1.19]	59 (10.5)	0.99 [0.73–1.35]	137 (24.4)	1.25 [1.03–1.52]
	≥10	321 (52.7)	1.04 [0.95–1.15]	247 (41.0)	1.11 [0.98–1.26]	74 (12.4)	1.17 [0.88–1.56]	161 (26.8)	1.38 [1.14–1.66]
Use of adjustable-height beds	Sometimes/never	122 (46.4)	1	98 (38.1)	1	34 (13.1)	1	59 (22.7)	1
	Always/often	1007 (51.2)	0.91 [0.79–1.04]	761 (38.8)	0.98 [0.83–1.16]	207 (10.7)	1.22 [0.87–1.72]	453 (23.3)	0.97 [0.77–1.24]
Training in handling in previous 5 years	No	488 (48.6)	1∇	368 (36.9)	1	104 (10.4)	1	228 (22.8)	1
	Yes	672 (52.1)	1.07 [0.99–1.16]	513 (40.0)	1.08 [0.97–1.21]	142 (11.2)	1.08 [0.85–1.37]	292 (23.0)	1.00 [0.87–1.18]
Seniority in the establishment (years of experience)	≤1 yr	267 (48.5)	0.97 [0.86–1.10]	183 (33.5)	0.99 [0.84–1.18]	140 (7.3)	0.97 [0.63–1.48]	111 (20.3)	0.93 [0.73–1.17]
	2–4 yr	258 (49.7)	1*	173 (33.5)	1***	39 (7.6)	1****	113 (21.9)	1∇
	5–10 yr	247 (47.6)	0.96 [0.85–1.08]	203 (40.0)	1.19 [1.01–1.40]	51 (10.7)	1.34 [0.90–1.19]	118 (23.3)	1.06 [0.85–1.33]
	>10 yr	375 (56.1)	1.13 [1.01–1.26]	312 (46.4)	1.38 [1.19–1.60]	113 (17.2)	2.27 [1.61–3.21]	175 (26.5)	1.21 [0.98–1.49]
Experience of work with elderly persons	1–4 yr	327 (46.7)	1**	210 (30.2)	1**	43 (6.2)	1****	131 (18.7)	1*
	5–9 yr	283 (46.8)	1.00 [0.89–1.12]	232 (38.9)	1.28 [1.11–1.50]	63 (10.6)	1.72 [1.18–2.49]	145 (24.4)	1.30 [1.06–1.61]
	10–19 yr	352 (54.7)	1.17 [1.05–1.30]	272 (42.4)	1.40 [1.21–1.62]	79 (12.5)	2.02 [1.41–2.88]	161 (25.2)	1.35 [1.09–1.67]
	>20 yr	198 (57.4)	1.23 [1.09–1.39]	167 (48.1)	1.59 [1.36–1.87]	61 (18.0)	2.93 [2.02–4.22]	83 (24.6)	1.31 [1.03–1.67]
Ratio of staff to residents	[0–0.42]	338 (50.6)	1	249 (37.4)	1	72 (10.9)	1	155 (23.4)	1*
	[0.42–0.50]	238 (50.6)	1.00 [0.89–1.12]	177 (38.7)	1.00 [0.87–1.17]	47 (10.1)	0.93 [0.61–1.31]	90 (19.4)	0.83 [0.66–1.05]
	[0.50–0.60]	263 (50.3)	0.99 [0.89–1.11]	218 (42.3)	1.13 [0.98–1.30]	64 (12.4)	0.13 [0.83–1.56]	142 (27.6)	0.18 [0.97–1.44]
	≥0.60	321 (50.7)	1.00 [0.90–1.12]	237 (37.5)	1.00 [0.87–1.15]	63 (10.1)	0.92 [0.67–1.27]	133 (21.2)	0.9 [0.74–1.11]
Number of beds	≤69	288 (49.8)	1	223 (39.0)	1	65 (11.5)	1*	130 (22.8)	1
	[70–89]	379 (50.2)	1.00 [0.90–1.12]	297 (39.5)	1.01 [0.87–1.16]	84 (11.2)	0.98 [0.72–1.33]	189 (25.1)	1.10 [0.90–1.33]
	[90–99]	155 (49.5)	0.99 [0.86–1.14]	110 (35.1)	0.90 [0.75–1.08]	18 (5.9)	0.51 [0.31–0.85]	69 (22.5)	0.98 [0.76–1.27]
	≥100	338 (52.2)	1.05 [0.94–1.17]	251 (38.8)	0.99 [0.87–1.15]	79 (12.3)	1.07 [0.79–1.46]	132 (20.6)	0.90 [0.73–1.11]
Type of home	Private	239 (48.6)	1.0	202 (41.4)	1	48 (9.9)	1	140 (28.7)	1**
	Non-profit	365 (50.4)	1.04 [0.92–1.17]	276 (38.1)	0.92 [0.79–1.06]	66 (9.2)	0.93 [0.65–1.33]	170 (23.7)	0.82 [0.68–0.99]
	Public-sector	473 (52.5)	1.08 [0.97–1.21]	346 (38.6)	0.93 [0.81–1.07]	108 (12.1)	1.22 [0.89–1.69]	173 (19.5)	0.68 [0.56–0.82]
	Other	83 (46.9)	0.96 [0.81–1.16]	57 (32.9)	0.79 [0.63–1.00]	24 (13.8)	1.39 [0.88–2.20]	37 (21.1)	0.74 [0.53–1.01]
Over-commitment	No	553 (42.6)	1****	40 (31.2)	1****	109 (8.5)	1****	225 (17.5)	1****
	Yes	591 (61.2)	1.43 [1.32–1.55]	470 (48.5)	1.55 [1.40–1.72]	132 (13.8)	1.61 [1.27–1.05]	289 (30.3)	1.73 [1.48–2.01]
Effort/reward imbalance	No	993 (48.3)	1****	753 (36.8)	1****	205 (10.1)	1***	430 (21.1)	1****
	Yes	155 (71.8)	1.48 [1.35–1.63]	122 (57.0)	1.55 [1.36–1.76]	39 (18.4)	1.82 [1.33–2.49]	84 (39.4)	1.87 [1.55–2.25]

Prevalence Ratio (PR), Confidence Interval (CI) ∇$p<0.1$. p significant: *$p<0.05$;** $p<0.01$; *** $p<0.001$;**** $p<10^{-4}$. Residents' mean dependence level does not correlate significantly with ULNMD at whatever location.

Table 5. Multivariate analysis taking account of work-related and non-work-related personal factors pert ULNMD location

		ULNMD location			
		Neck	Shoulder	Elbow	Wrist
		PR [95% CI]	PR [95% CI]	PR [95% CI]	PR [95% CI]
Age	<30 yr		1.0****	1.0****	1.0*
	30–39 yr		1.28 [1.04–1.57]	0.77 [0.41–1.45]	0.86 [0.70–1.05]
	40–49 yr		1.47 [1.22–1.77]	1.78 [1.04–3.08]	0.69 [0.56–0.85]
	≥50 yr		1.75 [1.45–2.10]	2.02 [1.13–3.61]	0.89 [0.66–1.25]
Children	No children			1.0***	
	No dependent children			2.03 [1.7–3.50]	
	≥1 dependent child			1.76 [1.09–2.84]	
Smoking	Non-smoker	1.0**			
	Ex-smoker	1.26 [1.09–1.47]			
	Smoker	1.21 [1.09–1.34]			
Schedule	Fixed-schedule daytime work	1.0*			
	Other	1.15 [1.02–1.29]			
Experience of work with elderly persons	1–4 yr	1.0**			
	5–9 yr	0.93 [0.80–1.06]			
	10–19 yr	1.14 [1.00–1.28]			
	>20 yr	1.09 [0.94–1.26]			
Occupational group	Housekeepers		1.0*		1.0****
	Nursing Assistants		1.17 [1.02–1.34]		1.03 [0.85–1.25]
	Nurses		0.99 [0.82–1.20]		0.57 [0.41–0.80]
Night-shifts	No		1.0*		
	Yes		0.78 [0.65–0.94]		
Seniority in the establishment (years of experience)	≤1 yr			1.29 [0.82–2.04]	
	2–4 yr			1.0****	
	5–10 yr			1.23 [0.80–1.91]	
	>10 yr			1.80 [1.22–2.66]	
Effort/reward imbalance	No	1.0***	1.0****	1.0***	1.0****
	Yes	1.30 [1.16–1.45]	1.30 [1.13–1.48]	1.69 [1.20–2.37]	1.49 [1.22–1.82]
Over-commitment	No	1.0	1.0****	1.0****	1.0****
	Yes	1.36 [1.22–1.52]	1.41 [1.26–1.59]	1.37 [1.05–1.78]	1.65 [1.39–1.96]

Prevalence Ratio (PR), Confidence Interval (CI). p significant: *p<0.05; ** p<0.01; *** p<0.001; **** $p\leq10^{-4}$

Wrist complaints

Age and number of dependent children were the personal factors associated with wrist complaints.

Type of job contract, job, daily work time, number of washings performed alone, number of beds made alone, experience of work with the elderly, staff/resident ratio, type of nursing home, over-commitment and effort/reward imbalance were the occupational factors associated with wrist complaints.

Full/part-time work, schedule, night-shifts, use of adjustable-height beds, training in handling in previous 5 yr, number of beds and residents' mean dependence level were not associated with elbow complaints.

Multivariate analysis (Table 5)

Multivariate analysis retained the following factors:

Neck complaints

Smoking (smoker versus non smoker Prevalence Ratio (PR=1.21 [1.09–1.47]), experience of work with the elderly (10–19 yr versus <1 yr, PR=1.14 [1.00–1.28]), schedule (other versus fixed schedule daytime) PR=1.15 [1.02–1.29], over-commitment (PR=1.36 [1.22–1.52]) and effort/reward imbalance (PR=1.30 [1.16–1.45]) were factors associated significantly with neck complaints.

Shoulder complaints

Age (≥50 yr, versus<30 yr PR=1.75 [1.45–2.10]),

job (Nursing Assistants versus Housekeepers PR=1.17 [1.02–1.34], over-commitment (PR=1.41 [1.26–1.59]) and effort/reward imbalance (PR=1.30 [1.13–1.48]) were factors associated significantly with shoulder complaints. Night shifts (PR=0.78 [0.65–0.94]) appeared to be protective factors with shoulder complaints.

Elbow complaints

Age (≥50 yr, versus<30 yr PR=2.02 [1.13–3.61]), dependent children (≥1 versus no children PR=1.76 [1.09–2.84], seniority in the establishment (>10 yr versus ≤1 yr, RR=1.80 [1.22–2.66], over-commitment (PR=1.37 [1.05–1.78]) and effort/reward imbalance (PR=1.69 [1.20–2.37]) were factors associated significantly with elbow complaints.

Wrist complaints

Age (40–49 yr, versus<30 yr PR=0.69 [0.56–0.85]), over-commitment (PR=1.65 [1.39–1.96]) and effort/reward imbalance (PR=1.49 [1.22–1.82]), were factors associated significantly with wrist complaints, while working as a nurse (PR=0.57 [0.41–0.80]), appeared to be protective factors.

"Number of beds made alone" and "number of washings performed alone" no longer entered as variables in the final multivariate model. The interactions "job/number of washings performed alone" and "job/number of beds made alone" did not significantly correlate with ULNMD in the final multivariate model.

To assess "job" as a confounding factor, multivariate analysis was performed excluding this variable: "number of washings performed alone" then remained significantly associated with shoulder complaints (p=0.005), and "number of beds made alone" with wrist complaints (p=0.02).

Discussion

Our study confirmed the association between occupational factors (physical, psychosocial and organizational) and upper-limb and neck musculoskeletal disorders in whichever joint.

The present frequency of neck and shoulder complaints agreed with literature data. In a prospective cohort study of 769 workers in nursing homes and homes for the elderly, Luime found a 19% 12-month incidence for neck MSD and 14.8% for shoulder MSD, with respectively 63.3% and 59.0% rates of recurrence over 12 months[17]. Alexopoulos *et al.* found 47% prevalence for neck MSD and 37% for shoulder MSD in the previous 12 months in Greek hospital nursing staff[26]. Roquelaure *et al.*, in a sample of 1,119 female employees in the Pays de la Loire administrative Region of France, found 50% prevalence for cervical MSD, 39.8% for the shoulders, and 16.5% for the elbows[27].

In our study permanent work contracts were found to associate with upper limb musculoskeletal disorders, although not after adjustment on personal factors (age) and other occupational factors (notably seniority). However a cross-sectional survey by structured interview in a sample of the active population of 15 European countries aged 15 years and over found that persons in precarious employment had higher rates of job muscular pains (20.1%) than those in permanent employment (16.9%)[28]. In this survey, muscle pain was more frequent in full-time than part-time workers; this was not confirmed in the present study, although an association emerged between musculoskeletal complaints and daily work time. In our study, seniority in the establishment was significantly associated with shoulder complaints. These findings are in agreement with those of Ohlsson[29].

In a systematic review of recent longitudinal studies, the biomechanical risk factors for neck WMSD (work-related musculoskeletal disorder) were heavy physical work, awkward posture and frequent lifting; for shoulder WMSD, heavy physical and repetitive work; for elbow WMSD, heavy physical work, awkward static and dynamic working posture and repetitive work; and for wrist WMSD, heavy physical work, awkward static and dynamic working posture and repetitive work[30]. In the present study, the daily number of washings performed alone, related to physical burden, correlated with neck, shoulder and wrist complaints during the previous 12 months. All the members of staff interviewed had physical burden, which may explain why prevalence ratios were not very high. In nursing homes, washings are usually performed by nursing assistants. They may involve awkward posture (notably, spinal flexion and torsion) and lifting. Lortie, in an analysis of work involving patient lifting, found that nursing assistants were exposed to postural stress, especially related to repeated patient manipulation[31]. In a systematic longitudinal search of the literature, Mayer *et al*. found strong evidence for an association between shoulder complaints and manual handling of material (odds ratio (OR): 1.4–1.9), trunk flexion (OR: 1.6–2.5) or rotation and working with hands above shoulder level (OR: 1.1–1.8)[32]. Arïens *et al.*, in a systematic review of the literature, highlighted associations between neck pain and certain work-related risk factors such as neck flexion, arm

posture and twisting or bending of the trunk[33]. According to Smedley *et al.*, physical tasks that require pulling or pushing with the arm and shoulder outstretched entail the highest risk of neck and shoulder symptoms[34]. In our study, wrist complaints were significantly associated with the number of beds made alone. Making a bed involves flexion-extension and pronation-supination of the wrists as well as lifting. In a 5-yr follow up study of 3,900 employees in Denmark, symptoms in the wrist-hand region were predicted in women by stress symptoms and twisting or bending[35]. After adjustment on personal factors and other occupational factors, the association between the numbers of beds made or washings performed alone and ULNMD no longer emerged, whereas associations between job and shoulder or wrist complaints persisted. The variable "job" was significantly associated with "number of washings performed alone" and "number of beds made alone".

When the "job" variable is removed from the multivariate model, "number of washings performed alone" remained significantly associated with elbow complaints, and "number of beds made alone" with wrist complaints. The variable "job" thus explains the model better than do the variables "number of washings performed alone" and "number of beds made alone".

Devereux *et al*. found that an interaction between physical and psychosocial risk factors in the workplace increased the risk of ULNMD, and that psychosocial risk factors emerged as the most important on multivariate analysis, although prospective studies would be required to corroborate these associations and the differences between risk factors[36].

In the present study, a long working week was not associated with neck pain, whereas a working day of more than 11 h was significantly associated with neck. However Eriksen found that the prevalence of neck pain in Norwegian nursing assistants increased with increasing working hours per week[37]. Lipscomb *et al.* reported that working >12 h per day in combination with >40 h per week was associated with a statistically significant increase in the odds ratios of neck (2.30; 95% CI [1.03–5.11]) and shoulder MSD (2.48; 95% CI [1.07–5.77]) in nurses; when models were adjusted for psychological and physical demand, the odds ratios remained elevated but were no longer significant, except for shoulder MSD[38]. In a longitudinal study, Trinkoff *et al.* reported that schedule-related factors associated with MSD included working days of 13 h or more, off-shifts, weekend work, work during time off and overtime; these increases in risk were not explained by psychological demand, but were largely accounted for by physical demand[39].

The present results, which found that psychosocial factors (effort/reward imbalance and over-commitment) associated with ULNMD even after adjustment on physical and personal factors, agree with literature data. Weman and al. highlighted that about two thirds of the nurses working in the nursing homes felt great pressure and demands from their nursing environment[40].

Analysis of multinational data for nurses and auxiliary staff in hospitals, nursing homes and home-care institutions in 7 countries in the European NEXT-Study revealed a pronounced relationship between psychosocial factors and back- or neck-pain-related disability, which was higher than the association with physical factors[41]. Gunnarsdottir reported that mental exhaustion after the shift, harassment, violence, or threats at work were the factors connected with symptoms from all the body regions studied[42]. High perceived job stress was consistently associated with all upper limb problems, and high job demands and monotonous work were associated with hand/wrist problems[43]. Gillen reported that effort/reward imbalance was a significant predictor of ULNMD in hospital workers (OR 1.5 [1.1–1.9])[44]. Van den Heuvel and Blatter showed that the psychosocial dimensions of the Effort-Reward Imbalance model also may affect neck and upper limb symptoms. This study showed that workers with high effort as well as workers with low reward reported more symptoms. The assumption of the model is that the combination of high effort and low reward is more unfavorable than the addition of their separate effects[45].

Besides Devreux *et al.* outlined a clear evidence of the relation between over-commitment and work related complaint expressed by the therapist[46]. Joksimovic *et al.* have suggested that over-commitment increase musculoskeletal pain[47].

Study limitations

The purpose was to identify which types of determinant were related to each body region, rather than to estimate relative incidence. The cross-sectional design was a further limitation, making it impossible to discuss causality in the model: the objective was not to make causal inferences but to study the situation of personnel with musculoskeletal symptoms. The cross-sectional study was limited to the current workforce, so that care workers who had left work due to musculoskeletal disorders or other health conditions were not included. The absence of these subjects from the study population may have led to underestimation of ULNMD prevalence. Another limitation was the use of self-

reported questionnaire data for musculoskeletal symptoms, but Nordic-style questionnaires exploring symptoms in the previous year can be useful tools for monitoring work-related upper-limb musculoskeletal disorder[23].

Non-occupational activities, such as housework, leisure and sports, were not assessed: they may increase ULNMD risk but seem unlikely to play a major role as confounding factors[48].

The present study did not distinguish between primary ULNMD and recurrence: history of ULNMD was not recorded.

This study also has a number of strengths. To the best of our knowledge, few studies have focused on the relation between working conditions in nursing homes and ULNMD. The present study was conducted in 105 nursing homes in the Rhône-Alpes Region, including 2,328 employees, with a high rate of participation (98.02%). The relations between occupational physical and psychological demand and ULNMD during the previous 12 months were determined for each ULNMD location. The measurement of ULNMD was done with a previously validated questionnaire, the Nordic Questionnaire[23] and psychosocial factors at work were evaluated with a validated French version of the Siegrist questionnaire[21].

Conclusion

In summary, this study illustrates the importance of psychosocial and physical work factors in relationship to ULNMD for health-care staff in nursing homes. Health-care professionals in nursing homes are subject to strong mental and physical demand. Special effort has been made during the past decade in France to improve equipment in structures for elderly dependent subjects. Adjustable-height beds, for example, are often systematic. Numerous renovations have been made. It now seems important not only to take account of physical factors to prevent musculoskeletal disorders, but also to reduce psychosocial demand at work.

Prospective studies are needed to clarify the causal role of psychosocial work factors, including organizational factors, in ULNMD outcome. Occupational physicians need to be more aware of psychosocial work factors that are associated with ULNMD.

Preventive approaches should take account of both physical and psychosocial work factors. Primary prevention measures may include the design of healthy organizations and work groups, where there is recognition of the importance of mutual respect and the balance between effort and reward at work.

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