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Hard work at home: musculoskeletal pain among female homemakers

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This study explores the relationship between housework and musculoskeletal symptoms among homemakers, adjusting for social, demographic and economic factors. A cross-sectional survey was carried out on 435 women from Nabaa, a low-income community in Lebanon. In total, 77% of women reported having musculoskeletal pain in the previous 12 months. Both psychosocial and physical factors showed significant associations with musculoskeletal symptoms. Related psychosocial factors included feelings of stress associated with homemaking and homemakers' number of children and self-rated health. The physical factors associated with musculoskeletal pain were feeling fatigued at the end of a housework day, working long hours and working in awkward postures or frequently engaging in repetitive hand movements. Ergonomic stressors were also associated with pain in the back and upper and lower extremities. Women from this community engage in a large number of hours of housework that, alongside other factors, were associated with high prevalence of musculoskeletal pain.

Practitioner Summary: This study contributes to the literature by studying women's housework activities in association with musculoskeletal pain. The role of women in homemaking activities is explored together with physical exposures leading to reported symptoms. This study adds a perspective of a Middle Eastern context to the literature of women's musculoskeletal health.

Keywords: ergonomics; homemakers; housework; musculoskeletal pain; women

1. Introduction

Musculoskeletal (MS) problems are one of the most common health concerns for working people (Riihimaki 1999, National Research Council 2001, Sharma *et al.* 2003, Treaster and Burr 2004, Shipp *et al.* 2009). Work-related exposures are a determinant of these ailments (Hales and Bernard 1996) and are associated with upper-extremity (Bernard 1997, Ariens *et al.* 2000, Messing *et al.* 2009), back (Shipp *et al.* 2009, Costa-Black *et al.* 2010) and upper- and lower-limb disorders (Ranney *et al.* 1995, Punnett and Herbert 2000). Work activities that involve heavy lifting, awkward postures, bending, twisting or stooping, prolonged sitting or standing and repetitive motions may contribute to the development of these problems (Ariens *et al.* 2000, National Research Council 2001, Punnett and Wegman 2004). In many occupational settings, women are at higher risk of developing a number of musculoskeletal (MS) symptoms compared to men (Punnett and Herbert 2000, Treaster and Burr 2004, Wijnhoven *et al.* 2006). Some authors suggest that differentials in household task participation may explain residual differences between men and women (Punnett and Herbert 2000, Treaster and Burr 2004).

Housework is traditionally a labour performed by women. It involves routine and compulsory household maintenance tasks (cleaning, cooking, purchasing, etc.) and family care duties (child rearing and other caregiving responsibilities) that require substantial physical, emotional and intellectual labour (Shelton and John 1996, Bianchi *et al.* 2000, Coltrane 2000). Studies have found that housework can be more energy intensive than some types of paid work (Sujatha *et al.* 2003, Brooks *et al.* 2004) and is a source of hazards comparable to other occupational settings (Messing 1998, Messing *et al.* 1998, Rosano *et al.* 2004, Yip *et al.* 2004, Habib *et al.* 2006b, 2010). Research has also found associations between housework and upper-extremity and lower back disorders (Mundt *et al.* 1993, Yip *et al.* 2001, Josephson *et al.* 2003).

Preliminary studies from Lebanon found that women engage in heavy workloads, both paid and unpaid, and bear a much greater share of housework responsibilities than men (Habib *et al.* 2006b). Women homemakers in Nabaa, a low-income Lebanese community, were socially pressured to perform many hours of household work. They felt judged by family members, neighbours and acquaintances for their

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ability to maintain a clean household; yet, many women also took pride in their household responsibilities, associating them with feelings of comfort and satisfaction (Habib *et al.* 2006a). Among women in Nabaa, MS symptoms were one of the most commonly reported health problems and were especially prevalent among women who at some point had been married (Habib *et al.* 2005). Research on MS health has traditionally neglected housework as a potential source of hazard. This study explored the relationship between housework and MS symptoms, adjusting for social, demographic and economic factors.

2. Methods

2.1. Population

Nabaa is a heavily populated, ethnically diverse, generally disadvantaged community on the outskirts of Beirut, Lebanon. Lebanese families residing in Nabaa originate from the regions of the south and Mount Lebanon. This research adopted the same sampling frame and study population of an earlier study, the Urban Health Study, conducted by the Faculty of Health Sciences at the American University of Beirut (Habib *et al.* 2005, 2006b, 2008). The Urban Health Study (completed in 2002) was based on a two-stage probability sample of 1151 households in Nabaa (83.4% response rate). A follow-up study in 2003 targeted all women between the ages of 15 and 59 years who were ever married, living in the 1151 households. Out of 939 eligible women, 682 participated in the 2003 study (response rate, 72.6%). Participants of the present survey (conducted in 2006) consisted of the sample of women surveyed in the 2003 study. Out of the 682 eligible women from the 2003 study, 435 consented to participate (a response rate of 63.8%). Women in the current study were between the ages of 18 and 62 years and were previously or presently married.

2.2. Study design and parameters

The study was cross-sectional, using a standardised structured questionnaire. A trained staff of female interviewers administered the survey with participating women at their residences in Nabaa. Holding interviews as opposed to self-administered questionnaires allowed women of all literacy levels to participate in the study. The participants were informed that they could stop the interview at any time and could elect to pass on any questions they chose. The study was approved by the Institutional Review Board at the American University of Beirut. Data collected from the survey ranged from participants' socio-demographic characteristics to their

general and MS health, as well as indicators assessing housework experiences.

Measures on socio-demographic and economic characteristics included age in years (grouped as less than 30, 31–40, 41–50, 51–60 and greater than 60), level of education (illiterate, primary, intermediate and secondary or higher), number of children (one to three or four or more) and paid-work participation during the previous 5 years (yes or no). Women were also asked if they were fatigued at the end of a typical housework day (yes or no), if housework caused stress (none to moderate stress or heavy stress) and their self-rated health – asked as ‘in general, how do you view your health?’ – (very good/good, average and bad/very bad).

Additionally, the survey included parameters measuring number of hours of housework per day, which were then grouped on a weekly basis (less than 46, 46–65, 66–84 and more than 84 h per week). Respondents were also asked to report the frequency with which they engaged in repetitive hand movements (never to occasionally and all the time) and whether they performed housework in awkward postures, such as bending, kneeling or squatting (yes or no). The main dependent variable under study was self-reported MS pain: ‘have you ever felt musculoskeletal pain in the last 12 months?’ (yes or no). Respondents were also asked to report on specific pain sites in the previous year by using a body diagram and sites were grouped into upper extremities, lower extremities and back pain.

2.3. Data analysis

Univariate descriptive statistics were used to describe the characteristics of study participants. Bivariate analyses were conducted to show the associations between self-reported MS pain and independent variables using chi-square tests. All variables with a *p*-value less than 0.25 were considered in the logistic regression model; other variables – including educational level, household income, smoking status and number of household members – which were considered relevant to the study were forced in the model (Hosmer and Lemeshow 2000). A logistic regression model assessed the association between reporting any MS symptoms and independent variables, adjusting for socio-economic and demographic factors. Three logistic regression models were fitted to test the association between specific site pain and ergonomic stressors in performing housework, while adjusting for socio-demographic variables, including age, education, involvement in paid work, household income and number of household members. The three models were as follows:

(1) upper extremity pain and repetitive hand movements; (2) lower extremity pain and awkward postures; (3) back pain and awkward postures. Absence of reported MS symptoms was used as the reference category together with derived adjusted odds ratios (ORs), 95% CI and *p*-values using the Statistical Package for Social Sciences 16.0 (SPSS, Chicago, IL, USA).

3. Results

The study found that 77% of women reported MS pain. Participants typically came from low-income families (76.8% reported family monthly incomes lower than 1,000,000 Lebanese pounds or US\$670) and 71.2% had not completed secondary school. The average age of women participating in the study was 44 years. Table 1 summarises the characteristics of the study population.

Participants included women in the paid labour force, as well as full-time homemakers (Table 2 presents information on the differences between the two groups). Nearly one-quarter (23.9%) of those surveyed were currently engaged in paid work, with 73.1% of those employed working more than 30 h per week and 26.9% working between 4 and 30 h per week (data not shown). Women engaged in paid labour were significantly more likely to feel tired at the end of a working day, to have dealt with a family crisis in the preceding month and to have spent fewer hours on housework compared to full-time homemakers. On the other hand, other housework-related variables, such as the number of children, housework causing stress and working in awkward postures or engaging in repetitive hand movements, did not show significant differences between the two groups. Notably, reporting MS pain did not yield a statistically significant difference between the two groups of women. Because all women shared similar characteristics in relation to the outcome variable, both groups – full-time homemakers and women engaged in paid work – will be referred to as homemakers from here on.

Table 3 presents the results of the logistic regression model for MS symptoms (with ORs and 95% CI). Indicators measuring the difficulty and strain of housework were most consistently associated with MS symptoms. Women who felt tired at the end of a typical housework day (83.9%) were 3.9 times more likely to report pain (CI = 1.83–8.40). Having four or more children was also significantly associated with MS pain (OR: 3.6; CI = 1.02–12.81), as were reports of heavy stress as a result of housework (OR: 2.2; CI = 1.03–4.73).

Body movements commonly associated with MS symptoms in occupational environments were also

significant indicators among homemakers. Women who worked in awkward postures during housework (86.2%) were 2.6 times more likely to report MS symptoms than those who did not (CI = 1.17–5.93). Moreover, those who frequently engaged in repetitive hand movement were more than twice as likely to report MS pain (OR: 2.7; CI = 1.37–5.33).

The number of hours of housework per week was also positively associated with MS pain. Women working 46–65 h were 2.5 times more likely to report pain than those working less than 46 h (CI = 1.09–5.65), while spending 66–84 h increased the likelihood substantially (OR: 4; CI = 1.34–11.89). However, there was not a significant finding for women who worked at home more than 84 h.

Self-reported health was also closely associated with the prevalence of MS pain among participants. Women who described their health as 'bad' or 'very bad' were 6.2 times as likely to report pain compared to women who perceived their health as either 'very good' or 'good' (CI = 2.53–15.15). Reporting health as 'average' was also significantly associated with MS pain, increasing prevalence 3.2 times compared to the control group (CI = 1.56–6.72).

Table 4 presents the results of the four logistic regression models for specific site pain. Women who frequently engaged in repetitive hand movements while performing housework were 1.85 times (CI = 1.19–2.89) more likely to report upper extremity pain than those performing such motions occasionally or never. Moreover, performing household tasks in awkward postures (bending, kneeling or squatting) was associated with reports of specific site pain in the lower extremities (OR: 1.92; CI = 1.01–3.67) and back (OR: 2.17; CI = 1.17–4.01).

4. Discussion

4.1. Main results

The study aimed to establish associations between housework and the prevalence of MS pain. A 12 month prevalence was high among homemakers (77%), comparable to a cohort of saleswomen in Thailand, who reported 77% prevalence, and 73% among professional cooks in Japan. However, the prevalence was higher than that found among office workers in Thailand (63%) and elementary school teachers in Brazil (55%) and an adult female population in Japan (42%) (Suka and Yoshida 2005, Nagasu *et al.* 2007, Janwantanakul *et al.* 2008, Cardoso *et al.* 2009, Pensri *et al.* 2009). This high prevalence suggests that it would be worthwhile to examine whether housework is an independent risk factor contributing to the development of MS disorders among women. In this study, it was found

Table 1. Characteristics of women, percentages of women reporting musculoskeletal pain and unadjusted odds ratios (ORs) with 95% CI (n = 435).

	n	(%)	n (%) Reporting MS pain		Unadjusted OR (95% CI)	p-value
Socio-demographic variables						
Working status of woman						
Involved in paid labour	104	(23.9)	85	(81.7)	1	
Full-time homemaker	331	(76.1)	250	(75.5)	0.69 (0.39–1.20)	0.19
Age (years)						
≤30	31	(9.5)	18	(58.1)	1	
31–40	128	(29.4)	99	(77.3)	2.46 (1.08–5.62)	0.03
41–50	165	(37.9)	126	(76.4)	2.33 (1.05–5.18)	0.03
51–60	93	(21.4)	76	(81.7)	3.22 (1.33–7.83)	0.01
> 60	18	(4.1)	16	(88.9)	5.77 (1.12–29.60)	0.03
Education*						
Illiterate	34	(7.8)	28	(82.4)	1	
Primary	141	(32.5)	109	(77.3)	0.73 (0.27–1.91)	0.52
Intermediate	155	(35.7)	117	(75.5)	0.66 (0.25–1.71)	0.39
Secondary or higher	104	(24.0)	80	(76.9)	0.74 (0.26–1.92)	0.50
Household income* (Lebanese pounds)†						
60,000–500,000	101	(29.2)	77	(76.2)	1	
501,000–750,000	99	(22.6)	78	(78.8)	1.15 (0.59–2.25)	0.66
751,000–1,000,000	85	(24.4)	62	(72.9)	0.84 (0.43–1.63)	0.60
> 1,000,000	62	(17.8)	49	(79.0)	1.17 (0.54–2.52)	0.67
Number of household members						
1–3	84	(19.3)	68	(81.0)	1	
4	118	(27.1)	90	(76.3)	0.75 (0.37–1.50)	0.42
5	124	(28.5)	90	(72.6)	0.62 (0.31–1.22)	0.16
6–10	109	(25.1)	87	(79.8)	0.93 (0.45–1.90)	0.84
Number of children at home						
≤3	353	(81.1)	265	(75.1)	1	
4–7	82	(18.9)	70	(85.4)	1.93 (1.00–3.74)	0.04
Health and mental health						
Ever smoked*						
Yes	229	(52.8)	177	(77.3)	1	
No	205	(47.2)	158	(77.1)	0.98 (0.63–1.54)	0.95
Woman feels tired at the end of a typical working day*						
No	69	(16.0)	36	(52.2)	1	
Yes	365	(84.0)	299	(81.9)	4.15 (2.41–7.14)	0.00
Woman's perception of her current health status*						
Very good/Good	123	(28.4)	71	(57.7)	1	
Average	173	(39.8)	141	(81.5)	3.22 (1.91–5.45)	0.00
Bad/Very bad	138	(31.8)	123	(89.1)	6.00 (3.15–11.44)	0.00
Housework causes the woman stress*						
None to moderate stress	294	(69.0)	214	(72.8)	1	
Heavy stress	132	(31.0)	115	(87.1)	2.52 (1.43–4.47)	0.00
Experienced a personal or family crisis in the past month*						
No	292	(67.4)	213	(72.9)	1	
Yes	141	(32.6)	121	(85.8)	2.24 (1.30–3.84)	0.00
Housework-related variables						
Housework (h/week)						
Less than 46	165	(37.9)	120	(72.7)	1	
46–65	140	(32.3)	115	(82.1)	1.72 (0.99–2.99)	0.05
66–84	65	(14.9)	54	(83.1)	1.84 (0.88–3.83)	0.10
More than 84	65	(14.9)	46	(70.8)	0.90 (0.48–1.71)	0.76
Repetitive hand movement during housework*						
Never to occasionally	203	(47.4)	146	(71.9)	1	
All the time	225	(52.6)	185	(82.2)	1.80 (1.14–2.85)	0.01
Awkward postures (bending-kneeling-squatting) while performing housework						
No	88	(20.2)	63	(71.6)	1	
Yes	347	(79.8)	272	(78.4)	1.43 (0.84–2.44)	0.17

*Missing values were not included in the table.

†US\$1 = 1500 Lebanese pounds.

Table 2. Comparison of full-time homemakers and women engaged in paid labour.

	Full-time homemakers (n = 331)		Involved in paid labour (n = 104)		p-value
	n	(%)	n	(%)	
Socio-demographic variables					0.15
Age (years)					
< 30	27	8.2	4	3.8	
31–40	92	27.8	36	34.6	
41–50	121	36.5	44	42.4	
51–60	75	22.7	18	17.3	
> 60	16	4.8	2	1.9	
Education*					0.49
Illiterate	28	8.5	6	5.8	
Primary	110	33.3	31	29.8	
Intermediate	118	35.8	37	35.6	
Secondary or higher	74	22.4	30	28.8	
Household income* (Lebanese pounds)†					0.29
60,000–500,000	75	28.3	26	31.7	
501,000–750,000	77	29.1	22	26.8	
751,000–1,000,000	70	26.4	15	18.3	
> 1,000,000	43	16.2	19	23.2	
Number of household members					0.57
1–3	59	17.8	25	24.0	
4	92	27.8	26	26.0	
5	96	29.0	28	26.9	
6–10	84	25.4	25	24.0	
Number of children at home					0.45
< 3	266	80.4	87	83.7	
4–7	65	19.6	17	16.3	
Health and mental health					
Ever smoked*					0.10
Yes	167	63.3	62	59.6	
No	163	36.7	42	40.4	
Woman suffers from MSD					0.19
No	81	24.5	19	18.3	
Yes	250	75.5	85	81.7	
Woman feels tired at the end of a typical working day*					0.04
No	59	17.9	10	9.6	
Yes	271	82.1	94	90.4	
Woman's perception of her current health status*					0.05
Very good/Good	89	27.0	34	32.7	
Average	126	38.2	47	45.2	
Bad/Very bad	115	34.8	23	22.1	
Housework causes the woman stress*					0.11
None to moderate stress	230	70.3	64	64.6	
Heavy stress	97	29.7	35	35.4	
Experienced a personal or family crisis in the past month*					0.01
No	232	70.5	60	57.7	
Yes	97	29.5	44	42.3	
Housework-related variables					
Housework (h/week)					0.00
Less than 46	106	32.0	59	56.8	
46–65	110	33.3	30	28.8	
66–84	55	16.6	10	9.6	
More than 84	60	18.1	5	4.8	
Repetitive hand movement during housework*					0.49
Never to occasionally	159	48.3	44	44.4	
All the time	170	51.7	55	55.6	
Awkward positions (bending-kneeling-squatting) while performing housework					0.09
No	61	18.4	27	26.0	
Yes	270	81.6	77	74.0	

MSD = musculoskeletal disorder.

*Missing values were not included in the table.

†US\$1 = 1,500 Lebanese pounds.

Table 3. Odds ratios (ORs) with 95% CI for presence of musculoskeletal pain among all women (n = 435), adjusting for socio-demographic variables (age, education, household income and number of household members).

	Adjusted OR (95% CI)	p-value
Socio-demographic variables		
Working status of woman		
Involved in paid labour	1	
Full-time homemaker	0.59 (0.26–1.36)	0.22
Number of children at home		
≤3	1	
4–7	3.61 (1.02–12.81)	0.04
Physical and mental health		
Ever smoked		
Yes	1	
No	1.40 (0.72–2.72)	0.31
Woman feels tired at the end of a typical working day		
No	1	
Yes	3.92 (1.83–8.40)	0.00
Woman's perception of her current health status		
Very Good/Good	1	
Average	3.24 (1.56–6.72)	0.00
Bad/Very bad	6.20 (2.53–15.15)	0.00
Housework causes the woman stress		
None to moderate stress	1	
Heavy stress	2.21 (1.03–4.73)	0.04
Experienced a personal or family crisis in the past month		
No	1	
Yes	1.89 (0.88–4.05)	0.09
Housework related variables		
Housework (h/week)		
Less than 46	1	
46–65	2.49 (1.09–5.65)	0.02
66–84	4.00 (1.34–11.89)	0.01
More than 84	0.56 (0.22–1.43)	0.22
Repetitive hand movement during housework		
Never to occasionally	1	
All the time	2.70 (1.37–5.33)	0.00
Awkward positions (bending-kneeling-squatting) while performing housework		
No	1	
Yes	2.64 (1.17–5.93)	0.01

that the number of housework hours worked, the number of children in the household, housework-related fatigue and stress and repetitive movements and awkward positions during housework were all significantly associated with MS pain.

4.2. Comparisons and contributions to the literature

Research has generally focused on the gendered work exposures in occupational settings. However, recent occupational health research has begun to focus on exposures in non-traditional occupational settings, such as the home and neighbourhood environment. For decades, feminist theorists have highlighted the exclusion of domestic housework from labour rights

and social justice agendas (Friedan 1963, Davis 1981, Hochschild 1989); yet only recently has occupational health research begun to study housework as a source of hazard. While several studies on occupational gender differentials in MS pain have hypothesised that housework may explain observed differences (Dahlberg *et al.* 2004, Punnett and Wegman 2004), few studies sufficiently address homemaking as a source of exposure (Habib *et al.* 2010). This study proposes that both paid work and unpaid domestic labour be considered by occupational researchers as potential sources of work hazards leading to MS symptoms. The Lebanese context, in particular, lends itself to this kind of research, as only a small proportion of women (24.8%) are involved in paid labour (UNDATA 2008) and a high proportion (>30%) of women suffer from MS pain (Habib *et al.* 2005, Zurayk *et al.* 2007). Given the gendered division of labour in Lebanon, it is counterproductive to consider work and work environments as only those involving paid labour. This study contributes evidence that women's homemaking tasks in similar social contexts may be a substantial source of risk for MS pain and may contribute to the development of MS disorders.

Although full-time homemakers were 40% less likely to report MS symptoms than women engaged in paid labour, the finding did not reach statistical significance. This result did not come as a surprise since women involved in the labour force confront the dual burden of housework and paid work. This dual burden is compounded in some Lebanese social contexts, where women are expected to shoulder a heavy share of household work regardless of employment status (Habib *et al.* 2006b). However, in the current study, employment was associated with a reduction in the number of hours of housework. Women may have actively reduced their household work due to their involvement in paid labour or may have spent fewer hours doing household tasks because they were away from their home for many hours each week (Habib *et al.* 2006b). Among employed women, 42% worked in occupations such as housekeeping, restaurant service and food processing, which share many work tasks and exposures with homemaking (data not shown). While full-time homemakers spent significantly longer hours doing housework, many of the participants involved in paid labour were engaged in additional work activities resembling those performed in the home.

The present results coincide with those of previous studies that have found positive relationships between MS pain and work stress (Bongers *et al.* 1993, 2002, Toomingas *et al.* 1997, Yip *et al.* 2001). Work stress is one of the major psychosocial factors associated with MS symptoms (Bongers *et al.* 1993). It has been

Table 4. Adjusted odds ratios (ORs) with 95% CI for women reporting pain in upper extremities, lower extremities and back, adjusting for socio-demographic variables (age, education, involvement in paid work, household income and number of household members) (n = 435).

	Reported pain*		Adjusted OR (95% CI)	p-value
	n (%) Upper extremity pain			
Repetitive hand movement during housework†				
Never to occasionally	81	(39.9%)	1	
All the time	122	(54.2%)	1.85 (1.19–2.89)	0.00
	n (%) Lower extremity pain			
Awkward postures (bending-kneeling-squatting) while performing housework				
No	30	(34.1%)	1	
Yes	133	(38.3%)	1.92 (1.01–3.67)	0.05
	n (%) Back pain			
Awkward postures (bending-kneeling-squatting) while performing housework				
No	32	(36.4%)	1	
Yes	168	(46.4%)	2.17 (1.17–4.01)	0.01

*Women who reported multiple site pain were counted in each category of pain they reported.

†Missing values were not included in the table.

hypothesised that work stress may cause stress responses, which result in physiological actions contributing to MS pain (Bongers *et al.* 2002). It is also possible that MS pain may cause stress responses, a hypothesis that cannot be excluded by this cross-sectional study. The finding that fatigue was associated with MS pain is consistent with the literature on janitorial and cleaning workers. Fatigue has been reported as a risk factor for MS pain among hotel cleaners – a worker group that engages in similar work tasks to homemakers (Kumar and Kumar 2008). In fact, fatigue may be a factor contributing to MS injury (Kumar 2001), while also arising from sustained experiences of MS pain (Strine and Hootman 2007, Fjell *et al.* 2008).

The present study also corresponds with research on the relationship between self-rated health and MS pain. A study conducted in Sweden among an adult population found that MS pain was closely associated with poor self-reported health and a lower quality of life (Molarius and Janson 2002). Similarly, studies in Canada and Greece found that MS pain was among the most important indicators related to fair or poor self-rated health (Perruccio *et al.* 2007, Alexopoulos and Geitona 2009). Physical health is a central component of self-perceptions of health and well-being (Jylha 2009), which likely explains why people experiencing MS symptoms have lower health status than those who are asymptomatic.

In the present study, MS pain among homemakers was associated with awkward work postures or repetitive hand movements. This finding is in agreement with the literature discussing work exposures related to MS pain (National Research Council 2001, Punnett and Wegman 2004). The biomechanical features of housework resemble those of tasks among

paid workers in child care, care-giving, food preparation and cleaning (Habib *et al.* 2010). Homemakers may engage in prolonged standing and repetitive hand movements during food preparation and dish-washing. Similarly, women frequently perform household tasks such as mopping/cleaning in narrow or difficult to reach spaces that require awkward postures, such as bending, kneeling and squatting. Grant *et al.* (1995) observed, among preschool workers with high rates of MS pain, several postures and activities that resembled the work of homemakers, including prolonged standing/walking, lifting of children and prolonged bending at the trunk. Another study of cleaners and janitorial staff whose job tasks mirror many household tasks – namely, mopping, dusting, sweeping and other cleaning activities – worked with their trunks extended, flexed, or in other awkward postures, and engaged in repetitive tasks and movements (McDiarmid *et al.* 2000). Studies have also observed frequent MS problems among commercial food service workers, who engage in repetitive movements with upper limbs, shoulders, wrists and fingers (Courville *et al.* 1994, McPhee and Lipscomb 2009). This is one of the very few studies that examined the relationship between housework ergonomic stressors and specific site MS pain.

The present results confirm previous findings in the literature on the association between repetitive hand movements and upper extremity symptoms. Barr *et al.* (2004) found that repetitive hand movements contributed in the development of MS disorders in the hand and wrist. In addition, Werner *et al.* (2005) reported that repetitive hand movements were associated with upper extremity pain and discomfort. Awkward postures (bending–kneeling–squatting) were

also associated with back and lower extremity pain among participating homemakers. Published research has found comparable associations between back pain and squatting (Yip *et al.* 2004) or bending (Hou and Shiao 2006, Reid *et al.* 2010) among cohorts of women from several occupational backgrounds. Similarly, a systematic review by Reid *et al.* (2010) reported that bending, kneeling and squatting have been linked to lower extremity pain in the literature. Housework tasks that typically require repetitive hand movements – including cutting, chopping and cooking food, as well as hand-washing dishes – are generally performed by homemakers (Habib *et al.* 2010). Likewise, household tasks such as tidying, mopping, sweeping, washing the floor and cleaning the bathroom may sometimes require awkward working postures (Habib *et al.* 2010). Homemakers regularly engage in these tasks, which are potential risk factors for upper extremity, back and lower extremity MS pain.

Working long hours was also linked with MS pain among homemakers. This mirrors studies of nurses, who were more likely to experience MS pain when working overtime, at weekends, or during off times (Lipscomb *et al.* 2002, Trinkoff *et al.* 2006). A review of work-schedule issues among healthcare workers found that working extended and difficult schedules may be associated with MS pain (Caruso and Waters 2008). This is relevant to homemakers because healthcare workers share in many similar activities, such as lifting bodies and prolonged sitting and standing (Habib *et al.* 2010). Long hours of work may contribute to the prevalence of MS pain by prolonging women's exposures to psychosocial and physical risk factors. A gradient in women's number of hours spent on housework was evident for MS pain. The non-significant negative correlation between performing more than 84 h of housework and MS pain (OR: 0.56; CI = 0.22–1.43) may be due to natural selection akin to the healthy worker effect. In other words, homemakers who are free of pain would be more likely to put in 12 h per day (or 84 h per week) of housework.

The finding that homemakers' number of children is associated with MS pain parallels other studies (Andersen and Gaardboe 1993, Sanders and Morse 2005). A survey of supermarket workers found that caring for children was a significant non-work environment factor contributing to reports of MS symptoms (Vroman and MacRae 2001). Prevalence of neck and shoulder problems among single women has been found to be positively associated with caring for children (Fredriksson *et al.* 1999, Björkstén *et al.* 2001, Yun *et al.* 2001). Similar studies of other occupational groups involved in childcare reveal that work with children can be very stressful and may be a

contributing risk factor to the development of MS symptoms (Messing *et al.* 1997, Ritvanen *et al.* 2004, Ritvanen *et al.* 2006). Fredriksson *et al.* (1999) found that an increase in the number of dependants leads to increased responsibilities, higher levels of stress and a reduction in women's leisure time, which all may contribute to the presence of MS symptoms.

Furthermore, the number of children a homemaker has had over the course of her life may have residual effects on her MS health. Even after children have moved out of the home, the cumulative impact of caring for them over the years may still lead to MS symptoms among women.

4.3. Contextualising the findings

Women in Nabaa spend a very high number of hours performing housework every week. Contextualising these findings requires that the role of social norms and their effect on women in some Lebanese communities are acknowledged. Lebanese patriarchal formations designate homemaking as a woman's work, thereby embedding it within local ideals of femininity (Habib *et al.* 2008). From this social location, distinct normative meanings have formulated around the role of homemaker and the responsibilities that it carries: a woman's success in maintaining her family home reflects on her feminine merits and competencies.

In this context, cleanliness takes on a new semiotics based on social status and difference. This assumed meaning, which equates cleanliness with a woman's social value, is what compels so many homemakers to engage in long hours of cleaning (Habib *et al.* 2006b). In a previous qualitative study, Habib *et al.* (2006a) found that women in the Nabaa community were very aware of this social meaning. Women felt judged by their friends and family members for their cleaning habits and would work hard to avoid criticisms of their performance. At the same time, women felt that they deserved appreciation and approval for their hard work but that their efforts went largely unnoticed by family members. Some women also derived pride from their ability as homemakers and strived to adeptly fulfil their social role. In these communities, women's cleaning habits were shaped by social expectations set by their husbands or other family members, fear of gossip and diminished reputation in the community and the importance of cleanliness to self-identity. In other words, internal, self-enforcing and external social pressuring forces led women to clean their homes tirelessly. As long as the social norms prevailing in Nabaa (and elsewhere) go unchallenged, the negative terms of women's work and MS and other health risks will persist among women living in similar contexts.

4.4. Limitations

The cross-sectional study design and aspects of the instrument limited the possibility of establishing causal inferences. The survey instrument was also limited, in that it did not include indicators measuring the intensity of housework or paid workload, nor the factors that might have alleviated its physical burdens – such as work–rest strategies (i.e. alternating between light and heavy tasks, taking regular breaks, etc.) that might affect the development of MS pain. Future studies of homemakers should incorporate questions on work–rest strategies. Additionally, the findings in this paper on self-reports of any MS symptom did not touch upon pain severity, which narrowed the scope of the conclusions. Future research should incorporate more descriptive assessments that explore other elements of pain.

Another potential issue arose in the analysis, where samples of women engaging in paid employment were combined with full-time homemakers. This was necessary because of the small sample size of participants in paid employment, a number that reflects national Lebanese figures of female participation in the workforce (21%) (Central Administration of Statistics 2008). Hence, the analysis controlled for the effect of labour force participation as opposed to stratifying during analysis. Because of a high prevalence of MS symptoms in the study population, the ORs generated by the logistic regression models may have been an overestimation of the measure of association (Skov *et al.* 1998).

5. Conclusions

This study found that homemakers engage in a large number of hours of housework, involving them in repetitive hand movements, bending, kneeling and squatting. These postures and movements were associated with MS pain. Symptoms were also related to psychosocial and individual factors. This research is the first epidemiological study to explore associations between ergonomic stressors in housework and specific site MS pain. Occupational health professionals must continue to include housework and homemakers within their research and policy agendas. In particular, future studies might explore the interaction between specific occupations, housework and specific MS symptoms. The analysis of these findings points to structural determinants – such as social norms and expectations – that shape the high level of women's involvement in domestic chores and how MS risk factors manifest. Future interventions and policies might intervene in communities, targeting families with messages that emphasise the health costs of excessive housework and the need to share household tasks among family members.

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