

Work-Related Musculoskeletal Complaints in Sonologists

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The prevalence of musculoskeletal complaints of the hand and wrist, and the neck and back, in physicians who operate sonography equipment was evaluated, and associations between these complaints and various work-related and personal variables were studied. A questionnaire survey was distributed among physician sonographers (sonologists) in Italy. The relationship between work habits and musculoskeletal complaints was analyzed by logistic regression models adjusted for gender, age, and duration of work with ultrasound. A total of 2041 physician sonographers completed the questionnaire. It was found that a large proportion of the subjects regularly had work-related complaints, such as neck and back pain (NBP) (18.5%) or hand and wrist cumulative trauma disorder (HWD) (5.3%). Roughly 80% of the sonographers were currently affected, or had been affected in the past, by one or more work-related symptoms. Various work-related factors appeared to be related to musculoskeletal syndromes. The average time spent for each examination was related both to NBP and HWD. Discomfort for transducer design was the best predictor of HWD, whereas a comfortable chair and correct position of the body protected from the onset of NBP. These results support the role of ergonomic factors in the pathogenesis of both NBP and HWD in sonographers.

Work in health care units has been shown to be associated with complaints relating to the musculoskeletal system.¹⁻¹⁵ Musculoskeletal disorders (MD) are the main reason for long-term sickness absence in health care workers.¹⁶ The term cumulative trauma disorder has been introduced to indicate an array of different MD that most commonly involve the upper extremities and the torso. Such disorders affect a number of occupations in the manufacturing and service sectors as well as in health care. Specifically, diagnostic medical ultrasound (sonography) seems to entail a significant risk of cumulative trauma disorder.¹⁷⁻²⁰

In the United States and the United Kingdom, sonography is performed mostly by technicians (sonographers), whereas in other European countries (eg, Italy) sonography is always done by physicians (sonologists). Both groups, however, seem to be similarly affected by cumulative trauma disorder, with upper extremities or neck and back pain as common complaints.

It has been suggested that, with respect to musculoskeletal symptoms, there is a relationship between the working positions inherent to diagnostic sonography (inefficient posture, frequent and forceful repetitive movements, extreme joint position) as well as ergonomic design and workstation configuration of sonography equipment, and the duration and number of examinations without rest. However, other combined factors (age, gender, physical activity) might also modulate the risk of developing MD in the individual.

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Thus, the purpose of this survey was to attempt to minimize musculoskeletal health hazards by: (1) establishing the prevalence of musculoskeletal symptomatology in physician sonographers (PS) in correlation with workload and work habits; (2) determining whether other factors such as age, gender, and physical activity may contribute to the development of discomfort in PS or exacerbate an existing problem; (3) ascertaining the need for modifying ultrasound equipment and/or work environment of PS; and (4) defining recommended workload and procedural techniques.

Materials and Methods

Survey Design and Distribution

The data analyzed in the present study were obtained from a survey among Italian PS, who were asked to complete a self-administered questionnaire.²⁰ The questionnaire included questions pertaining to: (1) personal and employment-related information; (2) scanning technique, work environment, workload and intensity (including the number of years worked, average days per week worked, average hours per day worked, average number of ultrasound procedures done, and the length of each patient's examination), and level of physical activity, defined as the number of days per week the respondent exercised for 20 minutes or longer in non-occupational activity (hobby, sport, etc.); and (3) occurrence of musculoskeletal symptoms. In its original version, the questionnaire had a 21-item symptom list that included questions as to whether workers "have now" or "had in the past" experienced hand and wrist symptoms, back or neck pain, and other work-related musculoskeletal symptoms. To reduce the number of complaints variables, and to confirm structure in the relationship between variables, we applied factor analytic techniques. By variance maximizing (varimax) rotation we obtained extraction of two prin-

cipal components: the first (eight items) was related to neck and back pain (NBP), the second (six items) to hand and wrist cumulative trauma disorder (HWD). For the purposes of analysis subjects were classified as having NBP if they reported four or more NBP symptoms, and as having hand and wrist disorder if they had three or more HWD symptoms at the time of the interview. This definition was chosen to exclude those with either transient or relatively mild complaints. We then compared the individuals who reported having such symptoms "now" (at the time of the survey) with those who did not have or who had experienced such symptoms only in the past. Subjects were classified as HWD or NBP as already defined, whereas all other subjects in the sample were classified as controls. Accordingly, the control group included those with no symptoms, or with transient symptoms (only in the past) related to hand and wrist or neck and back, respectively.

A pilot survey had been previously done with participants in Congresses and Courses on Sonography in Italy.²¹ No major survey problems were found. A cross-sectional survey was then performed. The survey form was mailed to the members of the Ultrasound Section of the Italian Society of Radiology (SIRM), and to the members of the Italian Society of Ultrasound in Obstetric and Gynecology (SIEOG) (in total, 2670 persons).

Analysis

The results were summarized in descriptive statistics. Mean and standard deviation were determined for continuous variables. Categorical variables were compared by using the chi-squared analysis or Fisher's exact test. The mean values were compared by *t* test. All comparisons were two-tailed. Association between exposure and symptoms was measured by univariate and multivariate unconditional logistic regression analysis.

Comparisons were made to establish the existence of links between particular work-related variables and the occurrence of musculoskeletal complaints. We first checked whether the variables of gender, age, duration of full-time work with ultrasound, number of working hours per day, and number of working days per week showed any relation to musculoskeletal complaint and work-related variables. Adjusted odds ratios (ORs) with 95% confidence intervals (95% CI) were then calculated as measures of association.

Univariate logistic regression analysis was used to correct for confounding; the actual confounder(s), and one independent variable were entered each time into the model. In the same way, ORs were calculated for the associations between complaints and all other work-related variables, taking the same confounders into account. As a last step, all independent variables that showed significant association, together with the relevant confounding variables, were included in a multivariate logistic regression model. Gender and age were entered into all of the regression models; other risk factors that reached significance during univariate analysis were entered in a backward stepwise fashion for the regression analyses of individual complaints. Work variables that failed to maintain a significant association with musculoskeletal complaints were eliminated from the models. For the variables that contributed significantly in the definitive model, the ORs and their approximate 95% CIs were calculated. These analyses were performed separately for all items related to both kinds of musculoskeletal complaints (NBP and HWD). Data analyses were conducted with SPSS/PC+ 4.01 software (Statistical Package for Social Sciences).

Results

From the national membership of the SIRM and of the SIEOG, 2041 responses were received, which cor-

TABLE 1
Upper Extremity Cumulative Trauma Symptoms in Sonographers

Hand and Wrist Symptoms	Have Now		Had in the Past	
	n	%	n	%
Tingling in the thumb and/or index and middle fingers	219	10.7	162	7.9
Numbness in the thumb and/or index and middle fingers	178	8.7	151	7.4
Tingling and or numbness in extremity(s)	259	12.7	164	8.0
Numbness in hands upon awakening	263	12.9	164	8.0
Pain at night in wrist and/or hand	347	17.0	128	6.3
Clumsy fingers	40	2.0	24	1.2

TABLE 2
Neck and Back Pain in Sonographers

Neck and Back Symptoms	Have Now		Had in the Past	
	n	%	n	%
Pain in neck and/or back	1109	54.3	673	33.0
Pain is intermittent	552	27.0	253	12.4
Pain at night in neck and/or back	347	17.0	172	8.4
Pain at the end of the day	519	25.4	227	11.1
Pain in standing or walking	231	11.3	127	6.2
Pain in sitting	254	12.4	114	5.6
Restriction of motion in the neck and/or back	478	23.4	235	11.5
Difficulty performing work or other activities as a result of your symptoms	193	9.5	129	6.3

responds to a total response rate of 76.4% (2041/2670). Most of the responders (1500, 73.5%) were male. Age (mean ± standard deviation) was 42.06 ± 7.21 years.

The vast majority of the subjects (81.9%) worked in hospital settings. Mean duration of employment was 9.3 ± 6.3 years. The duration of work exclusively with ultrasound devices ranged from 1 to 21 years, with a mean of 3.11 years. However, more than two-thirds of the subjects (1369, 67.1%) used ultrasound technique only part-time. More than half (57.7%) of the doctors had no physical non-occupational activity or exercised for less than 20' a week.

Musculoskeletal problems experienced during work were fairly common among the entire group of responders. Table 1 shows the occurrences of upper extremity symptoms. One-third of the respondents reported having "now" at least one or more work-related symptoms, mainly affecting the dominant hand.

The most frequent symptoms were tingling (12.7%), numbness (12.9%), and finger pain (17.0%). Table 2 shows the occurrences of NBP in PS. Most respondents (1253, 61.4%) complained of one or more symptoms; pain in neck and/or back being the most frequent (54.3%). Table 3 shows the prevalence of MD among PS. The prevalence of those who reported having had such symptoms in the past was even greater. Only 409 subjects (20.0%) denied any work-related symptom. Twenty-five percent of respondents (n = 502, 24.6%) had received treatments for their symptoms and 211 (10.3%) reported having temporarily stopped work because of their symptoms.

The previously defined criteria for HWD (ie, three or more HWD symptoms) was met by 109 subjects (5.3%). A diagnosis of carpal tunnel syndrome had been made in 35 of these subjects. Only 10 had undergone surgical intervention. In most cases, complaints were still present

TABLE 3
Number and Prevalence of Sonographers Experiencing HWD* and NBP†

	HWD		NBP	
	n	%	n	%
Male	79	5.3	253	16.9
Female	30	5.5	124	22.9
Total	109	5.3	377	18.5

* Hand and wrist cumulative trauma disorder: those having three or more symptoms (among those listed in Table 1) at the time of the interview.

† Neck and back pain: those who reported four or more symptoms (among those listed in Table 2) at the time of the interview.

after surgical treatment. NBP (ie, four or more NBP symptoms) was reported in 377 subjects (18.5%).

Working Conditions and Technique

The majority (62.2%) of responders performed ultrasound examinations for 4 or more days a week, for 3 or more hours a day. The average number of examinations performed a day was higher than 11.

Subjective assessment of the working conditions revealed that in more than one-half of the cases (59.7%) the chairs were adjustable in height; however, for most of the PS (53.9%) their chairs were at incorrect height, or uncomfortable, and did not provide adequate back support. Although the equipment settings were generally in a convenient position, the viewing screen was positioned either above eye level (21.7%), at eye level (45.2%), or below eye level (33.1%). Over two-thirds (85.9%) of the PS felt that the design of the transducer was comfortable, and over half of them (67.9%) used cable supporting devices.

Nearly half (44.5%) of the PS reported assisting with patient transfers from wheelchair to bed/examination table. When working, they all frequently inclined their neck and leaned over the patient, thus bending their back. When performing an ul-

TABLE 4
Sociodemographic Characteristics, Physical Activity, and Working Conditions^a of Respondents With or Without Musculoskeletal Complaints

Characteristics	All (n = 2041)	HWD (n = 109)	NBP (n = 377)
Gender (%)			
Female	541 (26.5)	30 (27.5)	124 (32.9)
Male	1500 (73.5)	79 (72.5)	253 (67.1)
Age (mean ± SD)	42.1 ± 7.2	46.1 ± 9.1*	43.7 ± 7.6*
Duration of full-time work with ultrasound (mean ± SD)	3.1 ± 5.4	4.8 ± 6.4*	4.0 ± 6.3*
Days worked per wk (%)			
<3	16.6	22.9*	9.0*
3-4	21.2	36.7	17.2
4-5	37.6	17.4	43.5
>5	24.6	22.9	30.2
Working hours per day (%)			
<3	16.1	22.0	11.9*
3-5	49.0	45.9	48.5
6-8	29.6	27.5	35.8
>8	5.3	4.6	3.7
Physical activity (times per wk) (%)			
0-1	57.7	78.0*	68.4*
2-3	49.0	22.0	31.6
4-5	3.9	-	-
6-7	1.7	-	-

^a Duration of ultrasound work, days worked per week, working hours per day.

* $P < 0.05$ with musculoskeletal complaints versus the remaining responders (without complaints).

trasound procedure, on average the body was in an upright position for about one-third of the time, whereas it was in a twisted, hunched over, or other position for two-thirds of the time. During each examination, the arm had to be hyperextended to reach the patient, at least for a fifth of the time.

Associations Between Complaints and Risk Factors

Table 4 shows associations between complaints and risk factors. Gender did not show a clear association with any of the musculoskeletal complaints. A significant association was found for the following parameters: (1) age and duration of full-time work with ultrasound devices with both HWD and NBP; and (2) number of hours per day worked with NBP, and the number of days per week worked with HWD and NBP. The amount of regular weekly physical activity, on the contrary, was negatively related with both

NBP and HWD. The aforementioned variables were also significantly associated with most of the work-related variables under study; therefore, we decided to adjust for them in further analyses. Also, on theoretical grounds we decided to correct for gender in logistic regression analysis.

Table 5 shows the ORs computed for each of the sites of musculoskeletal complaints. For some work-related variables under study, an increased OR was found. In univariate analyses, upright posture correlated negatively and twisted posture correlated positively with physical symptoms. Average time spent for each patient significantly increased the risk of both HWD and NBP. Uncomfortable transducer design and uncomfortable controls increased HWD risk. A comfortable chair significantly decreased the risk of NBP. As different work-related variables may be strongly interrelated, all of the variables found to be associated

with musculoskeletal complaints were entered in a multivariate model.

Table 6 shows the results of the analyses for all significant variables corrected for each other as well as for the relevant confounders. After adjusting for gender, age, duration of full-time ultrasound work and physical activity, and all other work-related factors, the average time spent for each patient remained a significant risk factor for both HWD and NBP, with ORs of 1.50 and 2.03, respectively.

An uncomfortable transducer design (owing to size, shape, or weight) was the best predictor for HWD (OR = 2.93). On the contrary, an upright position of the body and the use of a comfortable chair apparently protected from NBP (OR = 0.98 and = 0.55, respectively).

Discussion

In this study we tried to gain insight into the occurrence of several musculoskeletal complaints and the relation between these complaints and work-related factors inherent in diagnostic ultrasound. In fact, most of the time while performing an ultrasound study the examiner's arm holding the transducer is abducted and unsupported, and the cervical spine is flexed forward and rotated. Static or sustained isometric contraction of the neck, spine, shoulder, and upper extremity are necessary to support and fix the arm against the patient to maintain the transducer in the appropriate position needed to obtain the scan planes required. Conversely, dynamic or repetitive movements of the shoulder, forearm, wrist, hands, and fingers are needed not only to manipulate the transducer around the patients, but also to adjust the equipment settings with the opposite hand.

Objections could be raised about the validity of self-reported questionnaires in epidemiological studies. It is true that accuracy of the assessment of most workload factors by self-administered questionnaires is

TABLE 5
Occurrence of HWD and of NBP in Relation to Some Work-Related Factors in Sonographers (Univariate Analyses)*

Work-Related Factor	HWD (n = 109, controls = 1432)			NBP (n = 377, controls = 798)		
	OR†	95% CI	P Value	OR†	95% CI	P Value
Work pressure:						
Average no. of procedures each day	0.90	0.71-1.14	0.38	0.96	0.82-1.12	0.60
Average time each patient	1.41	1.02-1.97	0.04	2.00	1.61-2.50	<0.0001
Position						
Sitting position	1.00	0.99-1.00	0.22	1.00	0.99-1.00	0.64
Standing position	1.00	0.99-1.10	0.22	1.00	0.99-1.00	0.64
Upright position of the body	0.98	0.98-0.99	0.02	0.98	0.97-0.98	<0.0001
Twisted position	1.01	1.00-1.02	0.01	1.01	1.00-1.01	0.02
Hunched over position	1.10	1.00-1.02	0.03	1.00	0.99-1.01	0.39
Scanning with a hyperextended arm	0.82	0.62-1.09	0.18	1.15	0.97-1.35	0.09
Ergonomy						
Uncomfortable transducer design	2.75	1.71-4.45	<0.0001	0.67	0.44-1.01	0.06
Cable supporting device	1.28	0.79-2.07	0.31	0.85	0.64-1.12	0.24
Unadjustable chair	1.00	0.65-1.53	0.99	1.09	0.84-1.44	0.49
Comfortable chair	1.08	0.73-1.61	0.69	0.51	0.39-0.66	<0.0001
Viewing screen at eye level	0.92	0.61-1.39	0.69	1.27	0.98-1.65	0.07
Uncomfortable controls	1.47	0.71-3.01	0.30	1.64	0.93-2.88	0.07
Technique						
Actively scanning with a twisted wrist	1.00	0.99-1.10	0.10	0.99	0.99-1.00	0.22
Applying sustained pressure	0.99	0.98-1.00	0.18	1.00	0.99-1.01	0.06
Grip the transducer with high pressure	1.01	0.99-1.02	0.11	1.01	1.00-1.01	0.06
Grip the transducer with low pressure	1.0	0.99-1.00	0.85	0.99	0.99-1.00	0.46

* HWD, hand and wrist cumulative trauma disorder; NBP, neck and back pain; OR, adjusted odds ratio; CI, confidence interval.

† All odds ratios relative to subjects without musculoskeletal disorder were adjusted for age, gender, duration of full-time professional activity, and physical activity.

TABLE 6
Adjusted OR (95% CI) for HWD and for NBP in Relation to Some Work-Related Factors in Sonographers (Multivariate Analyses)*

Work Related Factor	HWD			NBP		
	OR†	95% CI	P Value	OR†	95% CI	P Value
Average time each patient	1.50	1.07-2.10	<0.01	2.03	1.62-2.56	<0.0001
Uncomfortable transducer design	2.93	1.82-4.72	<0.0001	-	-	-
Upright position of the body	-	-	-	0.98	0.97-0.99	<0.0001
Comfortable chair	-	-	-	0.55	0.41-0.73	<0.0001

* See Table 5 for definitions.

† All OR relative to subjects without musculoskeletal disorder were adjusted for age, gender, duration of full-time professional activity, physical activity, and for all other work-related factors that showed significant associations in univariate analyses.

not good for studying quantitative exposure-effect relationships in cross-sectional studies.²² Nevertheless, questionnaires for identification and assessment of severity of musculoskeletal complaints proved to be useful for epidemiological purposes.²³⁻²⁵ Subjective measures such as

self-reported pain, as opposed to clinical diagnostic testing, may be the most valuable approach to measuring outcome in a population-based survey.²⁴ Symptom questionnaires combined with checklist-based job hazard surveillance seem to be more sensitive indicators of

ergonomic hazards than other data sources.²⁶

It is commonly accepted that the prevalence of subjective complaints may be used to evaluate occupational ailments, in particular, MD caused by working habits and postures. The questionnaire we used for obtaining information on the perceived hindrance of working conditions and of musculoskeletal complaints was a modified version of a questionnaire that has already been used in a survey of cardiac sonographers in the United States.²⁰ The version we used proved to be a useful for recognizing work-related problems when tested in a pilot study.²¹ One might assume that symptoms will be exaggerated by subjects, consequently leading to an overestimation of their prevalence. However, the accuracy of the method used in this study is supported by the following facts: (1) the response rate in our study was 76%, so that bias resulting from selective non-response should be almost neg-

ligible; and (2) our subjects were physicians with sufficient knowledge to diagnose and explain disorders in the human body. Hence, it even seems acceptable to treat the results with respect to subjective complaints as a preliminary health examination.

Probably, the most important finding of our study is that musculoskeletal problems are fairly common among PS and may lead to temporary or permanent disability. Among our respondents about 10% reported temporarily leaving their professional activity because of such work-related disorders. It has been shown recently that sickness absence caused by MD is strongly inversely related to employment grade.²⁷ This may explain why the disability rate of PS is lower than the 17% disability rate found for sonographers in the United States.²⁰ Moreover, the involvement of our respondents with diagnostic ultrasound was, in most cases, on a part-time basis. It is conceivable that had this same survey been conducted with full-time PS, the results would show even higher rates of symptomatic subjects.

When focusing on the possible risk factors for MD, we may distinguish between individual (and/or psychosocial) and physical (or intrinsic to job) factors. Individual factors, such as age, gender, and exercise, were taken into account by previous studies as potential risk factors. In the study of Engels et al,²⁸ age was found to be associated only with arm and neck complaints among nurses. Several other authors have also found positive associations between age and back pain in nurses.⁸ In their recent review of the literature, Burdorf and Sorock²⁹ point out that the age-dependent pattern is present for more severe, chronic pain cases, whereas isolated pain episodes are not related to age. It is biologically plausible that age is an important factor in the development of back disorders. Previous researchers, however, reached contradictory findings. In certain studies age may be confounded with job demands, be-

cause older workers with more seniority often migrate out of more stressful jobs; but in our study both older and younger workers are performing the same job.

A history of sedentary work raises the likelihood of degeneration of the spine considerably. The load-bearing capacity of the spine decreases with age.³⁰ In our study, which compared people having more severe and persistent symptoms with those having only transient or mild complaints, age was found to be associated with both hand and back complaints. This finding is consistent with the literature.

With regard to gender, community-based surveys have consistently shown that women are at higher risk for MD than men. In these studies, however, women's and men's working conditions were quite different, and their musculoskeletal illnesses were related to some of their specific working conditions.³¹ In our cohort, men and women were exposed to the same range of physical stressors under study. Consequently, we did not observe gender differences.

Regular physical activity, on the contrary, was associated with a reduction of the prevalence of musculoskeletal complaints. It has been suggested that physical fitness would have a prophylactic effect on MD. Previous studies showed that physical training³² or involvement in sports³³ may reduce the likelihood of back disorders. Indeed, it is conceivable that a better fitness condition might have helped to prevent the subjects from developing such work-related symptoms.

With regard to factors intrinsic to work in diagnostic ultrasound, a dose-response relationship was found between length of full-time work as a PS and development of MD. More specifically, complaints about hand and wrist symptoms were found to be positively associated with number of hours per day worked, and with number of days per week worked. Similar associations were found by other studies on work-

related risk factors in nurses and cardiac sonographers.^{18,28}

The most likely reason for musculoskeletal complaints in workers performing physically light work is the worker's posture adopted during work. The literature suggests that postural load due to frequent bending and twisting of the trunk is positively associated with back pain.²⁹ Studies on video display terminal workers showed that the main cause of hand and wrist disorders is job design; the secondary (and lesser cause) is posture associated with workplace design: trunk incline, wrist extension, wrist ulnar deviation.³⁴ Concerning our subjects, the body posture during most operations may be summarized as follows: (1) head: bent forward, bent to one side, or twisted; (2) back: bent forward and/or twisted; (3) arms: shoulder raised at the dominant side, dominant arm extended and applying sustained pressure; wrist flexed or twisted; the other arm driving the controls; and (4) legs: sitting. Data analysis confirmed that posture had a significant influence on symptoms. Upright position of the body was a strong predictor of well-being; it was negatively related both to HWD and NBP in univariate testing, and to NBP in multivariate logistic regression. Conversely, a twisted or hunched over position tended to increase the risk of having symptoms.

When comparing wrist motions, both the twisting and pushing motions tended to correlate positively with hand and back symptoms. High-pressure grip had a positive correlation with symptoms; however, statistical significance was not reached. It is well known that static tension of the neck and shoulder/neck muscles may cause tension neck syndrome, which is a constant feeling of stiffness in the neck with neck pain.

Ergonomic factors played a leading role in the occurrence of symptoms: incorrect transducer design and uncomfortable chair were the most important predictors for arm and back disorders, respectively. PS

manually performed ultrasound examinations at a rapid rate, used strained postures, and often exerted excessive force. Results suggest that generation of restless force while working may contribute to the severity of upper extremity symptoms.

Low back pain may have been due to bending forward to access patients while seated. An inappropriate posture that required subjects to bend forward with their arms on the patient may have caused back and neck discomfort. A high proportion of PS make adjustments to the height and depth of their lumbar support, and different groups of users, with different physical characteristics, adjust the position of their lumbar support in distinct ways. It may be concluded that chairs with traditional padded fixed-height lumbar supports are unlikely to provide a comfortable or appropriate seat for the wide range of potential users.

Conclusions

The multitude of factors that may contribute to developing physical symptoms makes it hard to pinpoint which factors are the primary causes of work-related musculoskeletal problems among diagnostic ultrasound users. Some specific techniques and postures, however, show a strong relation to the number and severity of symptoms experienced by physicians/technicians performing sonographic examinations. Data analysis, by principal component analysis and stepwise backward elimination procedure, shows that the discomfort for ultrasound transducer design was the main determinant of upper arm complaints. On the contrary, low back pain seemed to be prevented mainly by correct (upright) position of the body and by adjustable and comfortable chairs. The time spent for each examination was another relevant risk factor: time-consuming investigative examinations may jeopardize the health of the PS. Therefore, emphasis should be placed on equipment design, as well as on work environment. Both

of these factors should be planned to allow the examiner to maintain a balanced posture. Special attention should be paid to stimulating the adoption of an ergonomic work posture and to ergonomic training. Ergonomic redesign of the workplaces seems to be the main goal in preventing musculoskeletal disorders in PS. Altering working positions can also be regarded as an effective measure to prevent muscular tension and orthostatic symptoms. Furthermore, workloads should allow for frequent breaks each day to provide sufficient recovery time of muscles from awkward positions and repetitive movement. All of these factors should be modified when requested of equipment manufacturers and hospital administrators. Finally, individual intrinsic ergonomic factors must also be recognized, addressed, and corrected by some combination of physical therapy, conditioning, technique retraining, education, and counseling.

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Be Joyful!

Talk about a holy war. As Canadians prepare(d) to file the(ir) tax returns . . . they . . . received a new commandment from the leader of their largest Protestant denomination: thou shalt "be joyful" about paying taxes. Only 2 years ago, the Rev Bill Phipps, leader of the United Church of Canada, admitted that he had doubts about the divinity and resurrection of Christ, but that they do not appear to extend to Canada's welfare state. Choirs could now sing "Ode to VAT" or "Nearer My Government to Thee." With a whopping 54% tax rate kicking in on an income of just \$41,722, Canada takes more in personal income taxes as a percentage of the economy than any other Group of Seven country. Certainly it provides a basis for the Gospel claim that the poor will always be with us.

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