

# Illness Behavior and Psychosocial Factors in Diffuse Upper Limb Pain Disorder: A Case-Control Study

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**ABSTRACT. Objective.** To compare behavioral and other psychosocial factors in patients with diffuse upper limb pain disorder (ULPD) and patients with carpal tunnel syndrome (CTS).

**Methods.** We compared 37 hospital outpatients with diffuse ULPD with 36 hospital outpatients with CTS, matched by sex, pain intensity, and duration of illness. We assessed psychiatric morbidity by a standardized interview, and both symptoms and personality by self-rated questionnaires. We measured illness behavior by assessing financial benefits and compensation, coping strategies, illness beliefs, treatments received, and 24 hours of monitoring movements of the most affected arm and the body as a whole.

**Results.** There were no significant differences in the prevalence of either current or premorbid psychiatric disorders, personality scores, symptom amplification, disability, or treatments received. Subjects with ULPD had significantly lower self-rated scores for depression, somatic distress, sleep disturbance, and physical fatigue than subjects with CTS, although there were more than normal levels of anxiety, fatigue, and sleep disturbance in both groups. There were no significant differences in the numbers of arm or body movements by day and night. Significantly more ULPD subjects had been involved in litigation, but litigating patients were a minority.

**Conclusion.** The primary etiology of endemic diffuse ULPD, presenting in secondary care, is no more psychiatric, psychological, behavioral, or related to personality than is the case with a similarly chronic and painful condition of known pathology. We cannot exclude either a specific role for psychosocial factors at work, or a more general role for psychosocial factors in maintaining disability in patients with chronic pain. (J Rheumatol 2003;30:139–45)

*Key Indexing Terms:*

UPPER LIMB PAIN DISORDER  
PSYCHIATRIC DISORDER

CARPAL TUNNEL SYNDROME  
ILLNESS BEHAVIOR

PERSONALITY  
MOVEMENT

Patients with endemic diffuse upper limb pain disorder (ULPD) can be considered as having pain and diminished function of the upper limb, in the absence of detectable pathology, which may or may not be related to certain work or occupations<sup>1-3</sup>. The popular term “repetitive...” or “repetition strain injury” (RSI), introduced during an apparent epidemic in Australia in 1982, has been criticized as wrongly implying that an injury is evident that has been caused by repetitive actions<sup>4</sup> and for being inappropriately used to describe conditions with well defined clinical features, such as tenosynovi-

tis<sup>3</sup>. Yet a study of 204 patients with occupation related pain in the upper limb or neck found that 42% had no clinically defined cause for their pain<sup>5</sup>. Therefore, diffuse ULPD is not a distinct diagnostic entity, but is a general term used to describe “non-specific diffuse forearm pain”; a diagnosis made mainly by exclusion<sup>2</sup>.

The etiology and pathogenesis of endemic diffuse ULPD are uncertain<sup>1-3</sup>. ULPD has been partially attributed to abnormal illness behavior<sup>1</sup>, with the most affected limb protected by inactivity<sup>6-8</sup>. Several psychological factors have been considered important<sup>1,6-12</sup>, with one author even suggesting that the condition is entirely a “psychogenic illness in a passive and dependent group”<sup>9</sup>. These factors include abnormal personality traits<sup>9,10</sup>, catastrophizing and generally poor coping skills<sup>11</sup>, work related stress<sup>1,10,11</sup>, mood problems or psychological distress<sup>1,10,12</sup>, as well as preoccupation with or amplification of physical symptoms and/or denial of psychosocial pressures<sup>6-8,10</sup>. These studies have observed patients with acute pain<sup>1</sup>, used either no controls<sup>12</sup> or healthy controls without pain<sup>6,7,10</sup>, used patients from tertiary care<sup>11</sup>, or were reviews<sup>8,9</sup>. So we cannot dismiss the possibility that the psychosocial factors were primarily related to suffering from a chronic and disabling pain. No studies of the prevalence of psychiatric disorders in diffuse ULPD have been published.

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Some authors have been impressed by the legally determined financial compensation for having the condition<sup>8,13</sup>, and one study found that workers litigate more if suffering from a diffuse ULPD rather than a specific disorder, such as carpal tunnel syndrome (CTS)<sup>11</sup>. Prolonged involvement in compensation claims might perpetuate ULPD, through its negative effects on health and an increase in emotional distress<sup>8,14</sup>.

We tested the primary hypothesis that subjects with ULPD would have a greater prevalence of both current and premorbid psychiatric disorders, compared to a chronically painful condition of known pathology. Second, they would also report more psychological distress, more abnormal personality scores, would move their affected arm less by day but more by night, and would more often claim financial compensation and benefits. We used a case-control design to establish that any significant associations with psychosocial factors were not related to having a chronic painful condition per se, believing this was necessary before examining the direction of any association in a prospective study.

## MATERIALS AND METHODS

**Subjects and controls.** We recruited 37 consecutive outpatients with ULPD; 18 from a London teaching hospital rheumatology clinic (secondary care) and 19 from a London hospital clinic that specialized in ULPD (tertiary care). Subjects suffered from nonspecific diffuse upper limb pain that had originated in the context of work or occupation<sup>2</sup>. Although it might be argued that the ULPD was therefore work related, the uncertain nature of that relationship motivates us not to label the condition in that way<sup>1,2</sup>. Subjects were aged between 18 and 65 years, of either sex, and were screened by an experienced rheumatologist (BLK) to exclude clinically defined conditions that would otherwise account for their pain and dysfunction. Excluded conditions included those defined by the "Birmingham criteria," including rotator cuff tendonitis, bicipital tendonitis, shoulder capsulitis, lateral and medial epicondylitis, and De Quervain's disease of the wrist<sup>2</sup>. As recommended, the published criteria were used as the framework for diagnosis<sup>15</sup>. The diagnosis of more proximal disorders, including neck disorders and thoracic outlet syndrome, was based on a clinical assessment using standard techniques<sup>16</sup>. Where relevant, electrophysiological studies were used to exclude radicular syndromes or compressive neuropathies. Similarly, systemic inflammatory conditions were excluded after clinical and laboratory assessment, which included full blood count, erythrocyte sedimentation rate, thyroid function tests, and both rheumatoid and antinuclear factor testing.

A comparison group of 36 outpatients with CTS was selected consecutively from the musculoskeletal departments (orthopedics and rheumatology) of the same 2 London teaching hospitals as the cases of ULPD. Controls were group matched by sex. We attempted to match the groups by age. We selected patients with CTS for our comparison group because this is also a condition of chronic upper limb pain, which is more common in women, but has a known pathology of median nerve entrapment<sup>17</sup>. This allowed us to control for the presence of chronic pain. The 36 recruited outpatients all fulfilled published criteria for CTS<sup>2</sup> and had pain, paresthesiae, or sensory loss in the median nerve distribution, together with a positive Tinel's or Phalen's test, and abnormal median nerve conduction time on electrophysiological testing. CTS subjects were not selected by a relationship between symptoms and work. Twenty three (64%) CTS subjects were on the waiting list for surgical release of the median nerve. Three subjects had already had (unsuccessful) surgery, 16 (44%) had had steroid injections, and 34 (94%) had received symptomatic treatments (analgesics, nonsteroidal antiinflammatories, splints, and physiotherapy).

We calculated necessary group sizes (of 36 in each group) in order to

detect a difference in the prevalence of psychiatric morbidity in patients with ULPD (predicted prevalence 60%, estimated from the literature) versus CTS (predicted prevalence 25%, as in the normal population), with 80% power and alpha = 0.05<sup>18</sup>. All subjects gave written informed consent and the project was approved by the East London and the City Health Authority research ethics committee.

**Interview and questionnaire measures.** We obtained demographic data and a clinical history by interview. We derived socioeconomic class from occupation, using the Office of Population and Census Surveys classification<sup>19</sup>. For those who had never worked, we derived socioeconomic class from the partner's or father's occupation. We measured height and weight to calculate the body mass index (BMI). We asked about receipt of state or private financial benefits, whether subjects had ever been involved in litigation in relation to their condition, and whether they were in receipt of or had sought any other form of financial compensation. We recorded data about the symptoms and any relationship between the illness and work or social activities. We obtained information about prescribed and over the counter medicines, and alternative therapies. We recorded whether the condition had affected working patterns or the number of hours worked, and we recorded the subjects' beliefs about the cause of their condition.

We assessed current and premorbid psychiatric morbidity by administration of the Structured Clinical Interview for DSM-IV Axis I disorders (SCID) by a trained interviewer<sup>20</sup>. We made one change by assuming that no subject had a somatoform pain disorder solely on the basis of their arm pain. Subjects completed the following self-rated standardized tests measuring psychological and symptomatic variables: Chalder fatigue questionnaire<sup>21</sup>, visual analog scales (VAS) for physical and mental fatigue<sup>22</sup>, Pittsburgh sleep quality index (PSQI)<sup>23</sup>, the hospital anxiety and depression scale (HADS)<sup>24</sup>, somatic discomfort questionnaire (which measures 50 separate physical symptoms)<sup>25</sup>, the somatosensory amplification questionnaire (measuring heightened sensitivity to physical symptoms)<sup>26</sup>, and the significant others scale (SOS), which measures the quality of social support received from close family and friends<sup>27</sup>. We chose these measures since these psychosocial variables had previously been shown to be abnormal in patients with chronic painful conditions.

The McGill pain questionnaire was used to assess pain<sup>28</sup>. The pain disability index and the health status questionnaire (SF-36) measured disability<sup>29,30</sup>. The pain coping strategies questionnaire was summarized to measure cognitive, helpless, and attention diverting coping skills<sup>31</sup>. The pain self-efficacy questionnaire is composed of 3 statements with which the subjects can agree to a greater or lesser extent: "There are things I can do to alter the severity of my symptoms." "I can do something about the outcome of my illness." "My own actions will influence the outcome of my illness"<sup>32</sup>. Three 100 millimeter VAS measured the strength of subjects' beliefs that the illness was physical, psychological, or due to emotional stress, with higher scores indicating stronger beliefs<sup>33</sup>.

Personality was measured with the revised Eysenck personality questionnaire short scale, which includes measures of emotionality (neuroticism), extroversion, and a lie (social responsibility) scale<sup>34</sup>. We also used the Frost multidimensional perfectionism scale to measure positive and negative perfectionism<sup>35</sup>. To estimate premorbid personality traits and to reduce the confounding effect of having a chronic pain on these measures, all subjects were asked to fill out the personality questionnaires as though they were not ill, after the method of Kendell and Discipio<sup>36</sup>. We also asked a nominated relative (usually the nearest) or close friend (of several years' standing) to complete the 2 personality scales, asking them to do so as if they were the subject in his/her premorbid state. We have previously used these 2 methods to estimate premorbid personality<sup>37</sup>.

Because of the detailed assessment of the subjects' clinical histories, we did not believe it was possible for the interviewer to remain truly blind to the diagnostic group, so we did not attempt to do so.

**Movement measures.** We measured whole body and upper limb movements with an ambulatory accelerometer (Series 2000 Minilogger; MiniMitter Co. Inc.), worn in a pouch around the waist, with one sensor attached to the wrist of the most affected arm and the other attached to the waist. The accelerom-

eter records the total number of movements detected in 30 second intervals. We asked subjects to wear the accelerometer for a continuous 48 hour period (apart from baths and showers), and to indicate the times at which they went to bed for the night and arose in the morning, to enable us to distinguish daytime from nighttime movements. We calculated the number of movements per hour over a continuous 24 hour period, using data from the first night and second day.

**Analysis.** Frequency distributions for all data except age were nonparametric and not bimodal. We therefore report results as median values and interquartile ranges (IQR). To test the significance of differences between the 2 groups, we used the Mann-Whitney U test for interval and continuous variables and the chi-square test for proportions. Within the ULPD subjects themselves, we compared psychosocial variables between those recruited from secondary and tertiary care. We also examined the possibly confounding effects of age and BMI on important variables, using a Pearson rank correlation or Mann-Whitney test, as well as socioeconomic class, sex, secondary versus tertiary care, and the presence of chronic widespread pain by chi-square test. Chronic widespread pain was classified as the presence of chronic pain in at least 2 contralateral quadrants of the body and in the axial skeleton, as in the American College of Rheumatology criteria for fibromyalgia<sup>38</sup>.

## RESULTS

**Participation and group matching.** Thirty-seven of 55 (67%) potential subjects with ULPD entered and completed the study, compared to 36 out of 60 (60%) potential CTS subjects. Of the nonparticipants, 13 patients (6 ULPD and 7 CTS) did not respond to the twice-mailed invitation to participate. Four patients (one ULPD and 3 CTS) were excluded because they were illiterate or spoke no English. Two subjects (one from each group) withdrew from the study because they found participation distressing. The remaining 23 non-subjects (10 ULPD and 13 CTS) declined to take part due to lack of time, domestic commitments, other unrelated health problems, or disinclination to travel to the hospital. There were no significant differences between groups in the reasons for nonparticipation. The sex distribution of the nonparticipants (ULPD 83% female, CTS 88% female) was very similar to the participants (see below), as was the age distribution, with medians (IQR) of 34 (29–44) years for ULPD and 47 (37–53) years for CTS.

The participating subject groups were well matched for sex, with a predominance of women (ULPD 87%, CTS 83%), but the CTS subjects were older by a mean of 8 years [mean (SD) age was 38 (9) yrs in ULPD subjects and 46 (8) yrs for CTS subjects;  $p < 0.001$ ]. There were no significant differences in either the duration of symptoms, with median (IQR) durations of 69 (20–98) months with ULPD and 60 (27–105) months with CTS ( $p = 0.81$ ), or in pain intensity (Table 1).

Twenty-eight ULPD subjects had unilateral symptoms (right arm in 23, left arm in 5) and 9 had bilateral symptoms. Of the CTS group, 30 had a diagnosis of unilateral CTS (right arm in 18, left in 12) and 6 had a bilateral condition. Among those with unilateral symptoms the dominant arm was affected in 20 (83%) ULPD subjects, compared to 18 (62%) CTS subjects ( $p = 0.16$ ).

**Socioeconomic data.** All the ULPD subjects were in socioeconomic class I to III, compared to 26 (72%) CTS subjects

**Table 1.** Pain and disability; median values (IQR). SF-36 maximum scores are 100 (= maximum capacity). Maximum present pain intensity = 5. Maximum pain rating index = 218. Maximum pain disability index = 70.

Measure	ULPD	CTS	p
Present pain intensity	2 (1–3)	2 (2–3)	0.72
Pain rating index	17.5 (10.5–28)	18 (12–37.5)	0.28
Pain disability index	30 (19–43)	29.5 (15–46.5)	0.77
SF-36 physical functioning	65 (55–75)	57.5 (26–75)	0.31
SF-36 social functioning	75 (55–100)	62.5 (38–88)	0.20
SF-36 mental health status	64 (58–80)	64 (49–83)	0.89
SF-36 emotional health	67 (0–100)	67 (0–100)	0.95

(chi-square 17.37, 4 df,  $p = 0.002$ ). Fifteen (41%) ULPD subjects were claiming benefits compared to 8 (22%) CTS subjects (chi-square 2.05, 1 df,  $p = 0.09$ ). Significantly more ULPD subjects had been involved in litigation with their employers over their condition: 13 (35%) versus 1 (3%) (chi-square 10.33, 1 df,  $p = 0.001$ ). Twenty-two (60%) ULPD subjects were in fulltime work, 5 (14%) in part-time work, and 10 (27%) were not working, in comparison with 20 (56%) CTS subjects in fulltime work, 8 (22%) in part-time work, and 8 (22%) not working (chi-square 1.00, 2 df,  $p = 0.61$ ). The most frequently undertaken work was administrative/clerical, which was the occupation of 14 (38%) ULPD subjects and 13 (36%) CTS subjects. Six (16%) ULPD subjects had a managerial job, compared to 5 (14%) CTS subjects. Eight (22%) ULPD subjects were in secretarial work, compared to 3 (8%) CTS subjects. No occupational comparisons were statistically significantly different.

**Observer rated psychiatric morbidity.** Fourteen out of 37 (38%) ULPD subjects had a current psychiatric disorder, compared to 8 of 36 (22%) CTS subjects (chi-square 1.44, 1 df,  $p = 0.23$ ). This represents a nonsignificant difference in prevalence of 16% (95% CI –5%, 36%). Table 2 gives the specific diagnoses. The prevalence of depressive disorders was very similar. Seven (19%) ULPD subjects had had a premorbid psychiatric disorder, compared to 5 (14%) CTS subjects (chi-square 0.07, 1 df,  $p = 0.79$ ). Socioeconomic class had no significant effect on psychiatric morbidity in either ULPD sub-

**Table 2.** Current primary psychiatric diagnoses. Some subjects had comorbid disorders, which are not shown. Percentages were rounded to nearest whole number.

Diagnosis	ULPD, n (%)	CTS, n (%)
Major depressive disorder	7 (19)	5 (14)
Dysthymia	2 (5)	2 (6)
Panic disorder	2 (5)	0
Alcohol misuse	1 (3)	0
Generalized anxiety disorder	1 (3)	0
Obsessive compulsive disorder	1 (3)	0
Post-traumatic stress disorder	0	1 (3)
Total number of cases	14 (38)	8 (22)

jects (chi-square 0.45, 2 df,  $p = 0.80$ ) or CTS subjects (chi-square 4.72, 4 df,  $p = 0.32$ ). Of the ULPD subjects, 2 of the 7 (29%) subjects who met criteria for chronic widespread pain<sup>38</sup> had a current psychiatric illness, compared to 12 out of 18 (40%) of those with only regional pain (chi-square 0.02, 1 df,  $p = 0.90$ ). Eight of 19 (42%) ULPD subjects from tertiary care had a current psychiatric illness, compared to 6 of 18 (33%) of those from secondary care (chi-square 0.04, 1 df,  $p = 0.83$ ). Neither age ( $p = 0.34$ ), sex (chi-square 1.17, 1 df,  $p = 0.27$ ), nor BMI ( $p = 0.79$ ) were significantly different in those ULPD subjects with a current psychiatric disorder compared to those without. Similarly, neither age ( $p = 0.67$ ), sex (Fisher's exact test,  $p = 0.19$ ), nor BMI ( $p = 0.35$ ) were significantly different in those CTS subjects with a current psychiatric disorder compared to those without. Being on the waiting list for surgery had no significant effect on psychiatric morbidity in the CTS subjects (Fisher's exact test,  $p = 1.00$ ).

*Mood, coping, attributions, and personality.* The ULPD subjects had significantly lower scores for depression, somatic discomfort, physical fatigue, and sleep disturbance than subjects with CTS (Table 3). There were no significant differences in the use of psychoactive medication, analgesics, or alternative therapies (data not shown). Both groups equally strongly believed their condition was physical and not psychological in origin. However, 32 (86%) ULPD subjects believed their condition was caused by work, compared to 11 (31%) CTS subjects (chi-square 21.33, 1 df,  $p < 0.001$ ).

**Table 3.** Psychological characteristics; medians (IQR). A PSQI score  $> 6$  is regarded as abnormal. A Chalder score of 14 of a maximum of 42 is normal fatigue. A total fatigue visual analog scale (VAS) score of 200 out of a maximum of 400 is normal; 100 out of 200 is a normal score for physical and mental fatigue. A HADS score  $> 7$  suggests a "possible" case,  $> 10$  suggests a "probable" case; 100 is the maximum attribution score.

Measure	ULPD	CTS	p
Sleep PSQI disturbance	7 (4–12)	11 (7–13)	0.04
Fatigue, Chalder <sup>21</sup>	17 (13–21)	20.5 (15–26)	0.06
Total fatigue, VAS	254 (201–319)	311 (251–351)	0.07
Physical fatigue, VAS	124 (109–163)	154 (131–180)	0.04
Mental fatigue, VAS	133 (103–153)	148.5 (101–176)	0.23
Anxiety, HADS	8 (5–11)	8.5 (5–12)	0.19
Depression, HADS	3 (2–7)	7 (3–11)	0.01
Somatic discomfort	16 (9–25)	28.5 (16–47)	0.001
Somatic amplification	8 (6–12)	8 (5–12)	0.52
SOS physical support discrepancy	1.2 (0.23–2.29)	1.37 (0.36–2.54)	0.69
SOS emotional support discrepancy	1.33 (0.43–2.57)	1.22 (0.2–3.11)	0.96
Physical attribution	91.5 (79–100)	94 (68–100)	0.53
Psychological attribution	6 (0–39)	12 (0–62)	0.37
Stress attribution	25.5 (6–62)	53.5 (13–82)	0.12
Cognitive coping	12.3 (9–18)	11.5 (6–17)	0.29
Helpless coping	8 (6–10)	6.5 (5–9)	0.13
Diverting coping	8.5 (5–14)	9.4 (4–15)	0.97

PSQI: Pittsburgh sleep quality index, HADS: hospital anxiety and depression scale, SOS: significant others scale.

Eighteen (49%) ULPD subjects particularly blamed repetitive movements, compared to 8 (22%) CTS controls (chi-square 2.64, 1 df,  $p = 0.03$ ). Fifteen (41%) ULPD subjects blamed stress at work (either pressure of work or interpersonal difficulties), compared to 3 (8%) CTS controls (chi-square 8.53, 1 df,  $p = 0.03$ ).

There were no significant differences in either pain intensity or disability scores (Table 1). There were no significant differences in any personality measure, apart from relatives scoring the CTS subjects as significantly more perfectionist (Table 4).

There were no significant differences in psychological characteristics, pain and disability scores, or personality traits between the 7 ULPD subjects with chronic widespread pain (CWP)<sup>38</sup> and the rest of the ULPD subjects, apart from a significantly greater attribution of their condition to psychological factors in the CWP subgroup. Median (IQR) psychological attribution scores were 47 (10–87) in the CWP subgroup compared to 4.5 (0–18.5) for the other ULPD subjects ( $p = 0.03$ ).

When compared to ULPD subjects recruited from secondary care, tertiary care ULPD subjects had higher median (IQR) HADS anxiety scores [9 (7–11) vs 5.5 (3–8) ( $p = 0.01$ )], higher median (IQR) negative perfectionism [53 (44–75) vs 35 (26–49) ( $p = 0.002$ )], and higher emotional personality scores [9 (6–10) vs 3 (1–6) ( $p = 0.002$ )].

*Physical measures and movements.* CTS subjects had a significantly higher median (IQR) BMI [31.1 (25.7–35.4) vs 23.6 (21.4–27.0) ( $p < 0.001$ )]. We found no significant differences in the frequency of movements of either the most affected arm or the body, by day or by night (Figure 1). For arm movements by day the probability value was 0.82, for body movements by day,  $p = 0.57$ ; for nighttime arm movements,  $p = 0.26$ ; for nighttime body movements,  $p = 0.98$ . The median (IQR) ratio of arm to body movements by day was 2.15 (1.48–3.69) in ULPD and 2.49 (1.62–3.76) in CTS subjects ( $p = 0.43$ ). The median (IQR)

**Table 4.** Personality traits by self-ratings and relatives' ratings; median values (IQR).

Measure	ULPD	CTS	p
Subjects' scores			
Total perfectionism	88 (77–109)	98.5 (60–118)	0.66
Negative perfectionism	46 (35–59)	45.5 (31–65)	0.94
EPQ emotionality	6 (3–10)	6 (3–8)	0.94
EPQ extroversion	8 (5–11)	8 (6–10)	0.43
EPQ lie	5 (4–7.5)	5.5 (3–8)	0.95
Relatives' scores			
Total perfectionism	81 (75–103)	101 (87–111)	0.02
Negative perfectionism	40 (35–55)	52 (42–62)	0.04
EPQ emotionality	5 (2–9)	6 (3–8)	0.89
EPQ extroversion	10 (7–12)	9 (5–12)	0.50
EPQ lie	5.5 (4–8)	7 (3–9)	0.43

EPQ: Eysenck Personality Questionnaire

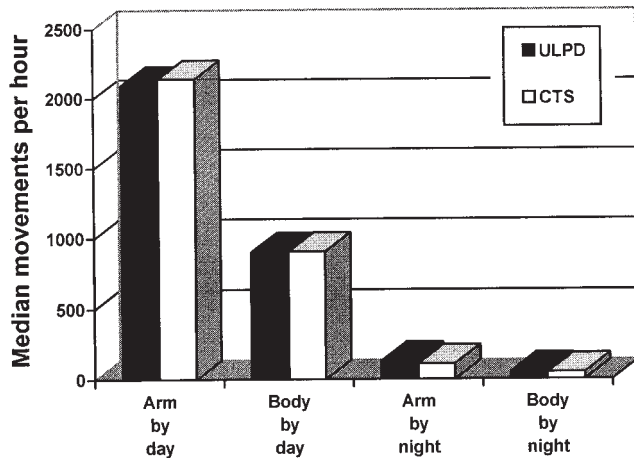


Figure 1. Median number of movements per hour.

ratio of arm to body movements by night was 2.47 (1.63–4.03) in ULPD and 2.19 (1.35–3.60) in CTS ( $p = 0.48$ ).

## DISCUSSION

In contrast to most previous research, we found no evidence to support the hypotheses that ULPD subjects have significantly more psychiatric disorders, are more psychologically distressed, or have more abnormal personalities, compared to CTS subjects. Indeed the ULPD subjects were significantly less depressed and distressed and had less sleep disturbance than the CTS controls. This was the opposite of what we expected. We measured movements directly, to give us objective evidence of illness behavior, and found almost identical numbers of movements per hour between the groups both by day and night. We also used the nearest relatives to rate subjects' personalities, which, if anything, suggested that the ULPD subjects had less abnormal scores.

Although a type II error could explain our similar findings between groups, due to a relatively small number of cases and controls, we had sufficient power to find roughly double the prevalence of psychiatric morbidity, had this been present as we expected. The prevalence in the CTS controls was as we expected. We found a lower than anticipated prevalence of psychiatric morbidity in the ULPD cases.

Case-control studies are prone to selection biases; could one have been present? The participating subjects and controls were not significantly different in age and sex from the non-participants, suggesting that the findings are probably representative of secondary care patients in general. The greater levels of anxiety and personality disturbance that we found in the tertiary sample on ULPD subjects would have led to more psychological disturbance in the ULPD cases, the opposite of our findings. Seven of the 37 ULPD cases also met criteria for chronic widespread pain<sup>38</sup>, but there was no significant difference in prevalent psychiatric morbidity between these 7 subjects and the rest.

Although the 2 subject groups were well matched by sex, the subjects with CTS were significantly older and had a significantly higher BMI, as would be expected with the known epidemiology of CTS<sup>17</sup>. We found that neither of these factors significantly confounded psychiatric morbidity, pain intensity, sleep, or mood disturbance, so we would discount these differences as explanations for our findings. Similarly, we found that socioeconomic class differences between the 2 groups did not confound the prevalence of psychiatric disorders. Most important, the 2 groups had a similarly high prevalence of depressive disorders (24% and 19%), perhaps reflecting living with chronic pain. The discrepancy between the similar prevalence of depressive disorders and the significant difference in median HADS depression scores is probably explained by the different symptoms incorporated in the 2 measures. The more objective interview finding of similar prevalence rates is probably more reliable.

The similar pain intensity, consequent disability, and duration of illness suggest that the findings were not caused by differences in these factors. This is important, since both ULPD and CTS pain can be intermittent, and any differences in pain, disability, or duration might have confounded differences in psychosocial measures. If our ULPD subjects had been more likely to deny psychological symptoms or problems<sup>7</sup>, we would have expected them either to have overemphasized physical symptoms such as pain or somatic distress, or to show symptom amplification; they did not. Finally, our lack of interviewer blindness should have biased us in the direction of our hypotheses, which were not supported, although this might help to explain the slight trend for a higher prevalence in the ULPD group.

The lack of significant differences in subjective measures was supported by more objective findings. Most important we found very similar numbers of arm and body movements per hour during both day and night. We also found that the nearest relatives' scores of subjects' personalities were similar to self-ratings (with the one exception of perfectionism, which was significantly more abnormal in the CTS subjects).

The lack of significant differences in coping strategies, treatments sought, and attributions support the similarities between the groups. The only significant attributional difference was blaming work, which might explain why the ULPD subjects had sought financial compensation more than the controls. This attribution is probably explained by both the pervasive view that "RSI" is caused by work<sup>3,13,14</sup> and our selection of cases of ULPD in the context of work. At the same time, it should be remembered that CTS itself can sometimes be related to work<sup>2</sup>.

We did not directly measure stress at work, which may play a role in ULPD<sup>1,39-41</sup>. Significantly more ULPD cases blamed work stress for their illness in this study. Several prospective studies have found that either psychological distress or stress at work predicted the later development of musculoskeletal pain in general and forearm pain in particular<sup>1,39</sup>.

Macfarlane and colleagues found that new forearm pain of at least a day's duration was predicted by both psychological distress and dissatisfaction with the support at work, measured a year previously<sup>1</sup>. These studies examined musculoskeletal disorders of uncertain diagnosis and/or short duration<sup>1,39,40</sup>. Since these reports did not specifically study chronic diffuse ULPD, they may not be directly relevant. In our study, significantly more ULPD subjects thought their condition was caused by work, particularly interpersonal stress, pressure of work, and repetitious tasks. This finding should be considered cautiously in view of our selecting ULPD cases that had developed in the context of work. In contrast to work, there was no significant difference between the 2 groups in social support at home.

We found only one other ULPD case-control study that also used controls with chronic pain<sup>42</sup>. Spence compared patients with chronic diffuse ULPD to patients with chronic upper limb pain following an accident (e.g., crush or burn). Similarly to our study, she found no significant differences in either psychological distress or personality scores between the 2 groups. Why have most other studies found a significant relationship between ULPD and psychosocial factors, whereas this study and that by Spence have not? First, finding no significant difference in 2 appropriately controlled studies does not exclude a role for psychosocial factors maintaining or exacerbating the severity of pain or disability in ULPD, as in any chronically painful condition<sup>43</sup>. The higher than normative levels of anxiety, sleep disturbance, and fatigue are consistent with chronic pain. Not having a longitudinal design, this study was not designed to elucidate the maintaining influence of psychosocial factors in chronic pain in general of whatever cause, although we hope to publish correlations. Burton and colleagues found that unsuccessful rehabilitation from ULPD was predicted by several psychosocial factors<sup>44</sup>. Second, epidemics of ULPD may have different etiological drivers from endemic ULPD<sup>4,8-10,13</sup>. Finally, psychosocial factors may be less important in regional pain compared to widespread pain<sup>40</sup>. Gower's 1892 description of occupational neuroses as "a group of maladies in which certain symptoms are excited by the attempt to perform some often-repeated muscular action,..." did not imply that the conditions were psychogenic<sup>45</sup>.

Various peripheral and central neurophysiological explanations for ULPD have been suggested<sup>7,46-48</sup>. We are most impressed with work suggesting that chronic regional pain disorders may be related to brain cortical sensitization<sup>47,48</sup>. We suggest that future work should focus on central nervous system mechanisms of pain perception and their relationship with psychosocial and mechanical stressors at work.

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