

# Work Related Upper Limb Disorders in Telecommunication Workers in Malaysia

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## Summary

A total of 323 workers from 5 different occupational groups in the telecommunication industry were studied in this cross sectional study, which sought to determine the prevalence of Work Related Upper Limb Disorders (WRULD) in 5 occupational groups; operators using the Video Display Terminals, switchboard operators, clerks, data entry processors and the supervisors. WRULD was also studied with regard to factors such as sex, race, height, age, stress and the discomfort perceived due to the work station design. The possibility of WRULD was determined from a self-administered questionnaire and confirmed by history and physical examination. Psychological stress and the discomfort due to the workstation were measured from the questionnaire. The overall prevalence was found to be 31.2% and the prevalence among the various occupations differed with it being the highest in the switchboard operators and data processors and the lowest in the supervisors. The older workers and the female workers were found to have higher prevalences of WRULD. It was also found that a higher stress score and a higher score of discomfort perceived at the work station were associated with higher prevalences of WRULD.

**Key Words:** WRULD, Work Related Upper Limb Disorders, RSI, Repetitive Strain Injury

## Introduction

Two hundred years ago, Bernadino Ramazini identified that occupational illnesses are caused by 2 types of workplace hazards; "the harmful character of the materials they handled" and "certain violent and irregular motions, and unnatural postures of the body<sup>1</sup>." The second category refers to a group of musculoskeletal disorders that develop gradually due to repeated trauma, that is accumulative injury to muscles, tendons, ligaments, joints which leads to inflammation, restriction of movement and specific disorders of certain units. These disorders have been referred to as Cumulative Trauma Disorders, Repetitive Strain Injuries (RSI), Occupational Overuse Syndrome and Work Related Upper Limb Disorders (WRULD) among others.

The Federal Bureau of Labour of the US reported that the number of cases reported had increased from 115,000 in 1988 to 240,000 in 1991<sup>2</sup>. In United Kingdom, RSI contributed to 5.18% of the total time lost from work due to work related illnesses<sup>3</sup>. In Australia, RSI has been estimated to cost the economy billions of dollars in reduced productivity, medical, rehabilitation, litigation and compensation costs<sup>4</sup>.

This disorder has been reported in many occupations and the prevalence is related to conditions of work. They vary from 3% to 98% in some high risk jobs<sup>5,6</sup>. There has however been very little work done regarding WRULD in this country. It is not known what the magnitude of the problem in Malaysia is. This study was conducted to obtain some basic data regarding WRULD in industry. Five groups of workers in the

telecommunications industry were identified and studied to determine what the prevalence was among these group of workers.

### Materials and Methods

This was a cross sectional study conducted between December 1994 and January 1995. The prevalence of WRULD was determined and compared among 5 groups of workers, namely two groups among the telephonists, the clerical staff, the data entry processors and the supervisors. An initial survey conducted revealed that the company had 17 departments and four departments were chosen which had larger numbers of these job categories. These 4 departments were International, Finance and Accounts, Central Department and Human Resources. All workers belonging to these five groups were included in the study.

The workers were briefed about the study and how to fill the questionnaire which included questions on personal particulars like age, sex, weight, height, hobbies and housework. The questionnaire also included questions about job training, their jobs and job stations, past medical history and symptoms of WRULD. Included in the questionnaire were questions to assess stress. For this, the Anxiety Stress Questionnaire of House and Rizzo<sup>7</sup> was used. A total of 387 questionnaires were distributed. Any worker willing to take part in the study was asked to present themselves at a specified room in the department for the interview and examination. To increase the respondent rate, the principal researcher went back repeatedly and reminded the workers that they could still take part in the study.

The questionnaire was reviewed and a physical examination was conducted on those who complained of symptoms of WRULD, that is of recurrent pain, discomfort, swelling or tenderness in the neck, shoulder or upper limb. The examination included a general examination and an examination of the upper limb and neck. The purpose of the examination was to determine if the worker was suffering from any other condition that could give a WRULD-like picture or if the worker was actually suffering from WRULD, the grade of the illness and the areas affected. The local examination involved inspection, palpation of the neck, shoulder and

upper limb. This also included assessment of tone, power, sensation and active and passive movements. A case of WRULD was defined as anyone who gave a history of recurrent pain or discomfort in the region of the neck or upper limb that lasted more than 2 months in total. Each episode of pain should have lasted more than 2 days. The history of pain and discomfort in the neck and upper limb had to have started only after being employed in the present job. There are however some conditions which give a WRULD like picture which needed to be excluded and these included previous injuries to the upper limb like fractures, dislocations and congenital deformities of the upper limb. Among the exclusion criteria were rheumatoid arthritis and other connective tissue disorders, gout, acromegaly, pregnancy, ulcerative colitis, hyperthyroidism and hypothyroidism<sup>8</sup>. Anyone with a second job whose tasks could also give rise to WRULD was excluded.

WRULD was graded using the Japanese grading:

- Grade 0 : No disease
- Grade 1 : Symptoms of recurrent pain or swelling in the neck, shoulder or upper limb lasting more than 2 days
- Grade 2 : In addition to the symptoms in grade 1, swelling or induration and/or tenderness in the region of the neck, shoulder or upper limb
- Grade 3 : In addition to the symptoms in grade 2, with sensory disturbance i.e. paraesthesia, numbness and/or weakness
- Grade 4 : Many of the symptoms in grade 3 but with more extensive sensory disturbance, more advanced decrease of muscle power and an increased number of positive neurological signs.
- Grade 5 : Activities of daily life affected in addition to work activities

The discomfort perceived due to the work station included whether the chair they used daily was too high, too low or acceptable and offered sufficient support for the back, whether the work station was too narrow or if they had to frequently reach for things beyond an arm's length, and if the hand and arm felt comfortable while working. The answers were scored such that a higher total score indicated a greater discomfort perceived.

The exposure to the risk factors for WRULD was determined with an observational model. One worker was chosen at random from each job category. Every 3 minutes this worker was observed for postures at work, repeated movements, pace of work, job tasks and situations that contributed to stress, all of which was recorded every 3 minutes. The amount of the working time spent on that activity, movement or posture was noted. Information was also obtained on the equipment used by the subjects.

The data was entered using Dbase 4 and analysed using Dostat and SPSS on a personal computer.

## Results

Using the observational method, it was found that the various groups faced various problems (Table I) that could contribute to WRULD. Among the international telephonists and the data entry processors it was found that they spent more than 90% of the working time sitting at a video display terminal (VDT). Both groups experienced repetitive movement of the fingers and forearms while keying in. The data entry processors kept the reference material beside the computer. They had to repeatedly turn their heads and look down to see the reference and the keyboard and look up to view the screen. Both groups held their arms beside the body, flexed at the elbow with forearms and hands pronated and heads slightly flexed. In between calls, the telephonists could rest their arms on the arm-rests and turn to talk to the person working beside them. The telephonists had minimal control over their work as they had to attend to calls as they came in. The performance of both groups was monitored electronically and by their supervisors which was a source of stress<sup>9</sup>. The data entry processors could take a break whenever they wanted to do so. However the data entry processors felt that there was a lot to be entered and that they needed to get it done by a certain date. The data entry processors did overtime to complete the job though this was voluntary. Both groups were working with the new keyboard which required minimal force for keying in. This keyboard had the numbers at the top and separately at the side so that they did not have to move across the keyboard when they had to key in a lot of numbers. The height of the seats of the chairs were adjustable and had a back

support which was also adjustable. Head flexion did not exceed 20° for the telephonists but the data entry processors did flex their heads more than 20° when reading the reference material. It was noted that despite being provided with equipment that made the workstation more comfortable, there were a number of workers who worked with hands extended and/or deviated at the wrists and who did not work at the correct height. On questioning the workers, it was found that their training did not include being told about working postures. The International telephonists were provided with footrests.

The domestic telephonists spent about 90% of the working time at a switchboard. They had the problem of static posture and repetitive work. Here they held the plug in the hand between the thumb and forefinger in a lateral pinch grip and repeatedly extended and flexed the arm at the elbow as well as straightening and ulna deviating the hand at the wrist. Some of them also sat in front of a VDT for part of their work time. Their chairs were adjustable but about a quarter of them were not adjustable any more. Some of the workstations were narrow and they worked with awkward postures. They too had no control over the work pace and were watched by their supervisors. They also complained of rude clients and crank calls which contributed to frustration and stress on the job.

The clerks carried out various tasks like writing, typing, reading, attending to visitors and photostating. They sat at a desk which was of a fixed height and on chairs which were not adjustable. Some of them used the old typewriter and the others a VDT. They had more control on the tasks as well as when they did them and could take their breaks when they wanted to. They seemed to have more time to interact with each other.

The supervisors did most of their work standing or while walking. They had the liberty of sitting when they wanted. They did not have any repetitive work to do nor did they have to work with any awkward postures. They did have problems with stress due to the responsibility that came with the job.

A total of 387 forms were given out but only 323 responded making the respondent rate 83.3%. The sample (n=323) was made up of 52 male workers and

**Table I**  
**Characteristics of Work and Work Stations**

Work Category	Risk factors	Beneficial factors
Tele (I)	Static posture ( >90% of time) Repetitive work (keying in) Electronic monitoring Minimal control over pace of work	Adjustable Chairs with armrests New keyboard (more ergonomic) Head flexion <20°.
Clerical	Static Posture ( 75% of time) Repetitive work (typing) Chairs not adjustable so posture of head at work for some >20°. Some of the chairs have no armrests. Some typewriters with old keyboard	More control over pace of work Longer rest breaks A variety of tasks
Data P.	Static Posture ( >90% of time) Repetitive work (keying in) Repetitive work (turning head and looking down to read reference material and then at screen and keyboard). Electronic monitoring Overtime contributing to long work hours	Adjustable chairs with armrests New keyboard
Tele (D)	Static Posture ( >90% of time) Static posture ( holding plug) Repetitive work (extending and flexing arm) No control over pace of work Some (20%) chairs not adjustable	
Supervisors	Stress from responsibility	A variety of tasks and postures No static postures More control over pace of work

271 female workers. There were 107 cases diagnosed as WRULD but 9 were excluded. One of them suffered from psoriasis, another 2 gave a history of fracture of the humerus in the past, one of whom had a radial nerve injury, one was a case of ulcerative colitis<sup>10</sup>, one gave a history of a shoulder dislocation following an accident, one gave a history of a recent sports injury following which the complaints started, one of them suffered such symptoms during the premenstrual period only and one of them had a straight back

The overall prevalence of WRULD among these workers was 31.2%. The prevalence among male workers was 17.3% and differed significantly from the prevalence among female workers, that is 33.2% ( $\chi^2=4.49$ ;  $p<0.05$ ). The male and female workers differed significantly with regard to age, weight, height, duration of service and discomfort score (Table II). There was however no difference with regard to the stress score between male and female workers (Males mean stress score =13.0; Females mean stress score 13.3;  $t=1.31$  and  $p>0.05$ ).

Those with WRULD were found to have a mean age of 38.2 years and standard deviation (SD) of 9.8 years while those without WRULD had a mean age of 33.6 years and SD of 8.0 years ( $t$ -test:  $t=4.32$ ;  $p<0.05$ ). Similarly those with WRULD had a mean stress score of 14.2 with SD of 2.0 that was significantly higher ( $t$ -test:  $t=6.0$ ;  $p<0.05$ ) than that of those without WRULD (mean 12.8, SD 1.6). Those with WRULD had a mean discomfort score of 5.3 and SD of 1.0 while those without WRULD had a discomfort score of 4.8 and SD of 0.9 ( $t$  test:  $t=3.74$ ;  $p<0.05$ ). With regard to weight the mean weight of those suffering from WRULD

(mean weight 62.5; SD 13.9) were significantly heavier ( $t$  test:  $t=4.2$ ;  $p<0.05$ ), than those who did not (mean weight 54.1; SD 10.4) have WRULD.

The prevalence of WRULD among the different categories of workers differed (Table III) with the highest among the switchboard telephonists (41.8%) followed by the data entry processors (40.0%). The lowest was among the supervisors (13.7%). The different groups of workers were however found to differ significantly with regards to age, weight, duration of service, height, discomfort score and stress score. The supervisors had the highest mean age and duration of service followed by the domestic telephonists. The highest stress scores were found among the data processors and switchboard telephonists. The prevalence of WRULD among the various job categories also differed (Table III) significantly when the prevalences were compared only among the female staff to remove the effect of gender. Among the female workers, the data entry processors had the highest prevalence (66.7%) followed by the switchboard telephonists (41.8%). The supervisors had the lowest prevalence (13.7%).

The discomfort perceived was measured from questions on the workstation and how they felt at work. It was found that the data entry processors scored the highest (mean 5.92; range 5 - 7) followed by the clerks (mean 5.44; range 3.8) and the lowest were the VDT operating telephonists (mean 4.31; range 4 - 8). Those with WRULD had a mean discomfort score of 5.26 that was significantly higher than those without WRULD with a mean score of 4.84 ( $t=3.74$ ;  $p<0.05$ ).

**Table II**  
**Comparison of Male and Female Workers**

Variable	Male Workers	Female Workers	Statistical test
Age (years)	31.6 (8.2)	36.0 (9.6)	$t=3.02$ ; $p<0.05$
Duration of Service (years)	5.7 (6.7)	13.3 (9.4)	$t=6.08$ ; $p<0.05$
Weight (kg)	65.9 (13.8)	57.2 (12.2)	$t=4.46$ ; $p<0.05$
Discomfort Score	5.4 (0.8)	4.9 (0.9)	$t=3.35$ ; $p<0.05$
Stress Score	13.0 (1.8)	13.3 (1.9)	$t=1.31$ ; $p>0.05$

**Table III**  
**Prevalence of WRULD and Sex Distribution by Job Category**

Job Category	No. of Male Workers	No of female Workers	WRULD cases among women	Overall prevalence (%)
Tele (I)	0	96	24 (25.0%)	5.0
Clerical Work	39	48	19 (39.5%)	27.5
P. Data	13	12	8 (66.7%)	40.0
Tele (D)	0	86	36 (41.8%)	41.8
Supervisors	0	29	4 (13.7%)	13.7
Prevalence%	17.3	33.2		31.2

**Table IV**  
**Comparison of Age, Duration of Service and Weight by Job Category**

Job Category	Age (years) mean (s.d)	Duration of Service (years) mean (s.d)	Weight (kg) mean (s.d)
All Workers	35.3 (9.5)	12.2 (9.5)	58.6 (12.9)
Tele (I) n=96	29.6 (9.1)	8.0 (8.2)	55.3 (12.2)
Clerical work n=87	33.9 (8.1)	9.3 (7.9)	60.4 (14.6)
D. Processors n=25	30.6 (7.4)	4.0 (4.8)	61.1 (14.5)
Tele (D) n=86	40.7 (6.6)	18.2 (6.8)	58.8 (11.7)
Supervisors n=29	46.6 (4.8)	22.5 (8.8)	61.9 (10.1)
ANOVA	F=34.4; p<0.05	p<0.05	p<0.05;

WRULD is not a single disease but is instead a group of conditions. So WRULD was further divided into conditions affecting the neck, shoulders, upper arm, forearms and wrists and hands. It was found that the conditions affecting the shoulder had the highest prevalence of 27.0% followed by conditions affecting the neck (26.3%). This was true for all groups of workers except the international telephonists who had a higher prevalence of neck conditions followed by shoulder problems. Conditions affecting the wrists and hands were found to be high among the data processors

and the domestic telephonists. Most of the workers who had WRULD had grade 1 disease (17.8%) with 4.8% with grade 2 and 7.0% with grade 3 disease. 1.0% had grade 4 and 0.6% had grade 5 disease. The remainder had no disease.

The five work groups differed significantly (using ANOVA test) with regard to age ( $F=34.4$ ,  $p<0.05$ ), duration of service ( $p<0.05$ ), weight ( $F=2.68$ ,  $p<0.05$ ), stress score ( $F=5.44$ ,  $p<0.05$ ) and discomfort score ( $F=34.78$ ,  $p<0.05$ ) (Table IV and V). Due to the

**Table V**  
**Comparison of Height, Stress Score & Discomfort Score by Job Category**

Job Category	Height (cm) mean (s.d)	Stress Score mean (s.d)	Discomfort score mean (s.d)
All Workers	157.0 (7.1)	13.3 (1.9)	5.0 (0.9)
Tele (I)	156.0 (5.2)	12.8 (1.7)	4.3 (0.7)
Clerical Work	159.9 (9.7)	13.0 (1.6)	5.4 (0.8)
D. Processors	163.8 (10.2)	13.9 (2.3)	5.9 (0.8)
Tele (D)	154.4 (4.0)	13.9 (2.0)	5.1 (0.9)
Supervisors	155.4 (4.0)	13.1 (1.8)	4.7 (0.6)
ANOVA		F=5.4 ; p<0.05	F=34.72; p<0.05

differences among the groups of workers of the different job categories and of both sexes, all variables that were found to have a significant association with WRULD were included in a multiple logistic regression. It was found that a higher prevalence of WRULD was associated with older age, female sex, heavier weight, higher stress score and a higher discomfort score. Certain types of jobs were associated with a higher prevalence of disease with the odds of having the condition being highest among the data processors (20 times), followed by the clerks (17 times), domestic telephonists (13 times) and supervisors.

Multiple logistics regression was used to determine the relationship between the variables that were found to be significantly associated with WRULD. The equation determined was as follows:

$$\log(p) = -13.6 + 0.06 \text{ age} + 0.46 \text{ stress} + 0.05 \text{ weight} - 1.75 \text{ male sex} + 2.6 \text{ job (international telephonist)} + 2.8 \text{ job (clerk)} + 3.0 \text{ job (data processor)} + 1.8 \text{ job (domestic telephonist)}$$

where  $\log(p)$  was the log of the probability of developing WRULD.

## Discussion

The overall prevalence of WRULD among the workers of this telecommunications firm was found to be 31.2%. The prevalence rate among the women workers was found to be higher (33.2%) than the prevalence among

male workers (17.3%). This was also found in many other studies<sup>11,12</sup>. This has been attributed to many factors. Excessive force can cause muscle injury i.e. muscles can be strained causing temporary swelling and aching or a small group of fibres can be torn. If forced to continue working despite this injury, the muscle is not given time to repair itself. With the strength of women being less than their male counterparts, women tend use more force thus making them more prone to injury. Among healthy female employees the mean value of maximum static shoulder muscle strength was found to be less than half of the average male subjects<sup>11</sup>. Women are smaller than men but most work stations are built according to the "average Joe" rather than the "average Jane"<sup>8</sup>. This may be an added problem where Asian women are concerned if most workstations are designed for the average Western male. This may cause them to adopt and work with postures that may cause muscular skeletal disorders. Women also have smaller structures like a smaller carpal tunnel and are thus more prone to symptoms of compression of structures within the tunnel. However in this study the male workers were significantly younger than the female workers.

Another factor found to be associated with a higher prevalence of WRULD was older age. With increase in age, strength decreases and tissues become less elastic and so tend to injure more easily. Healing is also delayed; thus an increase in age is expected to be associated with an increase in the prevalence of WRULD<sup>8</sup>.

We had found that those who suffered from WRULD had a higher mean weight compared to those who did not. Disorders like the carpal tunnel syndrome and cervical problems are noted to be higher in those who are overweight. It is probable that the nature of work is an additional risk factor in this group.

In this study it was found that those with WRULD did have a higher mean stress score than those without WRULD. Psychological factors have been reported to be associated with a higher prevalence of WRULD<sup>3,13,14</sup>. This may be due either to an increased risk of injury or an increase in the likelihood of reporting. It has been thought that stress causes the general tone of the muscles to increase. This contraction of muscles especially in addition to a static posture will lead to increased production of metabolites and less blood flow to remove them<sup>13,14</sup>. The metabolites like lactic acid accumulate and damage the muscles. In addition, there may be poor sleep and an inability to relax during the rest periods so that repair is hampered. Basically WRULD is thought to be a disorder where damage occurs due to force or metabolites with the tissues not being given the time to recover or repair itself.

Another factor reported to be associated with an increased prevalence of WRULD is repetitive work<sup>2,13</sup>. Highly repetitive work requires muscular effort that does not allow sufficient recovery time<sup>13</sup>. Silverstein reported that significant positive associations were observed between hand and wrist Carpal Tunnel Syndrome (CTD) and high repetitive jobs as well as high force<sup>16</sup>.

The overall prevalence rate was found to be 31.2% but it was not possible to compare with other studies as the definitions differed. The prevalence rates among the various job categories in this study differed (Table III) with the rates being highest among the domestic telephonists (41.8%) followed by the data entry processors (40.0%) and the lowest among the supervisors (13.7%). The supervisors were older than the other workers, were all female and had a higher mean weight than the other groups. But despite having all the personal risk factors they still had the lowest prevalence. The Australian Public Service in its attempts to monitor the scale of the problem among its employees carried out a RSI census between 1985 and 1987. The prevalence

among clerical administrative staff was 1%, clerical assistants 2.7%, typists 8% and data processors 24.1%<sup>17</sup>. A scientific study by Armstrong et al in 1993 showed that there was an increased risk among certain job categories<sup>15</sup>. Thus the nature of the job also contributed to the prevalence of WRULD.

The data entry processors did a lot of repetitive work. They keyed in data at the rate of an average of 9,000 key depressions per hour (KDH) with a range of 6,000 to 11,000. In 1964 the Japanese Ministry issued guidelines that the keyboard operators work no more than 5 hours a day with 10 minutes breaks every hour and perform less than 40,000 keystrokes a day. In 1986 the Australians recommended the KDH rates be kept at or below 10,000 and the limit be 5 hours a day<sup>18</sup>. The data entry processors did this for more than 90% of the work day which lasted 7 hours excluding overtime. It was thus expected that they would have a high prevalence of hand and wrist problems which they did. In addition to the repetitive work for long periods, they also were stressed. They were electronically monitored. The literature quotes that anxiety related to performance, productivity and job prospects adds to the muscle load thus predisposing to the development of symptoms<sup>9</sup>. Thus monitoring is anxiety causing. The data entry processors were noted to repeatedly turn the head and flex the neck and did a lot of overtime. So it was expected that they would have a high prevalence of neck problems. This they did have but they also had an equally high prevalence of shoulder problems despite working with adjustable workstations.

The domestic telephonists comprised of only female workers and had a higher mean age. They also had a high mean weight (Table IV). The domestic telephonists repeatedly plugged and unplugged the connections for about 95% of the workday. They were monitored by their supervisors. The monitoring and difficult customers did cause stress among the latter group. It was noted that although generally all groups had more neck and shoulder problems, the domestic telephonists had a high prevalence of hand and wrist problems too.

From the observational study it was found that the problem with the clerks was the fixed workstation. They did not have much repetitive work. They had control



over the pace of work and did not seem under a lot of stress. They had however a high discomfort score (Table V). The perceived discomfort might be a good indication of a problem with WRULD at the work place.

From the SOCSO report of 1993<sup>19</sup> the number of cases of injuries due to cumulative trauma was low giving the impression that this may not be a problem among our workforce. However from the data of the US, the UK and Australia, it is a major problem. We believe that there is under reporting of these conditions among our workforce. In this group of workers it was found that the prevalence was 31.2%. According to Kvanstrom<sup>11</sup> the prevalence among blue collar workers is higher than that among white collar workers. It is therefore postulated that this condition is present among our workforce but that it is not being diagnosed and thus being underreported. When an injury occurs due to a single event, it is easy to make the link between the cause and the resulting disorder. With cumulative trauma disorders this is not so evident. Only with a greater awareness among the doctors who serve the industries will the condition be recognised and reporting better reflect the situation in industry. It is only then can improvements be made at workstations and the job itself to alleviate this problem.

## Conclusion

The objective of this study was to determine the prevalence of WRULD among 5 groups of staff of a telecommunications organisation. From the data available from reporting of these conditions to the monitoring agencies such as the Department of Occupational Safety and Health or SOCSO the prevalence of this disorder was very low but in this study the overall prevalence was found to be 31.2%. The prevalence of WRULD was found to be higher among women and older workers. A higher prevalence was noted among those with higher stress scores. The prevalence varied between job categories making the odds of having WRULD higher among certain jobs. It was also found that a higher prevalence was noted among those with a higher discomfort score. It is therefore possible that the discomfort perceived could be used as an indicator to predict who might be at higher risk.

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