

# AN INVESTIGATION INTO COMPLAINTS OF WRIST PAIN AND SWELLING AMONG WORKERS AT A FACTORY MANUFACTURING MOTORS FOR REFRIGERATORS

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## ABSTRACT

*In 1987, a group of workers complained through their union that some of them developed wrist pain and swelling from the manual handling of heavy stators. The complaints were from the morning shift of a particular assembly line in a factory making motors for refrigerators. The precipitating factor appeared to be the change in the weight of the model assembled. The new stator weighing 5.8 kg was about twice as heavy as the previous model. Each worker on the line handled 300 to 1,000 stators per shift. The work involved included lifting the stators onto and off the conveyor belts and pushing and pulling them along horizontal planes.*

*To evaluate the problem, workers from both shifts of the affected assembly line were interviewed and examined. A total of 79 workers (all females) was involved. The presence and severity of work-related aches, pains, numbness, swelling, etc over the last 4 weeks were enquired. The nature of the work done in the line was observed.*

*Sixty-three out of 79 workers had some symptoms giving an overall prevalence rate of 79.8%. The two most common complaints were pain (90.5%) and numbness (28.6%). The most commonly affected sites were the hands and wrist followed by the neck and shoulder. There was no significant difference in the prevalence of symptoms among workers in the 2 shifts. The symptoms were subjective and associated with job dissatisfaction and there was no difference in the average number of stators handled between those with symptoms and those without. However, a positive correlation between those with significant symptoms and the number of stators handled was found. (Significant symptoms are those symptoms which are present for at least 15 days over the past one month and which either required treatment or affected the workers' daily activities). The prevalence of such symptoms was 34%.*

*A revisit to the factory in 1991 showed that the recommendations on the design of the workstations to minimise lifting of motors, job rotation and training of workers on proper lifting techniques were implemented and there were no further complaints.*

*Keywords: musculoskeletal aches and pains, manual lifting, job dissatisfaction, upper limbs.*

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## INTRODUCTION

In March 1987, a group of eleven workers complained through their union to the Labour Ministry that some of them developed wrist pain and swelling from the manual handling of heavy stators. The complainants were from the morning shift of a particular assembly line in the Stator Assembly Section of a factory making motors for refrigerators. The precipitating factor appeared to be the change in early 1986 of the model assembled. The new stator weighing 5.7 kg was about twice as heavy as the previous model. An investigation was launched to evaluate the significance of these complaints.

## METHODS

Only workers from both shifts of the affected assembly line were interviewed and examined as the company was reluctant to involve workers from other lines in the survey. A total of 79 workers (all females) was studied - 41 from the morning shift and 38 from the afternoon shift. Questions on personal particulars, nature of work and the presence of symptoms over the past 4 weeks eg aches and pains, swelling, numbness, and/or tingling

sensation, and the site affected. The significance of the symptoms were qualified by asking for the number of days affected, medical leave, relation to work, treatment if any and whether daily activities were affected. They were also asked whether they were satisfied with their job.

A clinical examination included inspection and palpation, testing of the motor power and range of movements, reflexes touch, pain and vibration sensation of the upper limbs.

The nature of the work done in the line was observed.

Statistical analysis was carried out using the chi-square tests and the t tests of probability.

A revisit was made in 1991 after the workstations were modified to see if there were further complaints.

## RESULTS

### Nature of work

The factory manufactures motors for refrigerators. The section under study assembles the stator part of the motors. (Stator Assembly Section). There are several lines in this section assembling different stator models. Each line assembles a particular model and operates on 2 shifts. Each worker on the line handles 300 to 1000 stators per shift. The work involved includes lifting the stators onto and off conveyor belts, and pushing and pulling them along horizontal planes. Each line has 20 workstations assembling different parts of the stator. Both shifts of the same line assemble the same model.

Each worker was given a break of about 10-15 minutes after 2-2½ hours of work and a lunch/dinner break of 25 minutes.

### Prevalence of Symptoms

Sixty-three of 79 workers had some symptoms relating to the musculoskeletal system giving an overall prevalence rate of 79.8%.

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The two most common complaints were pain (90.5%) and numbness (28.6%) (Table I). Other complaints were swelling and stiffness. Among those with complaints, 63.5% had pain as the only symptom. 14.3% had both pain and numbness, 4.8% had numbness only and 4.8% had pain and swelling. Table II gives the prevalence of symptoms by sites involved. The most common sites affected were the hands and wrist followed by the neck and shoulder. The most common sites of pain were the hand and wrist (59.6%). The hand and wrist were also the most common site for numbness (89%), swelling (100%) and stiffness (100%). Table III gives an idea of the severity of the symptoms. About 41% had the symptoms daily. Thirty-eight per cent of the workers claimed that their daily activities were affected. 68.3% had to self-medicate and/or seek medical treatment for their discomfort and 9.5% required medical leave because of their symptoms.

**Table I – Prevalence of symptoms relating to the musculoskeletal system among workers during the 4 weeks.**

Symptoms	Workers (n = 63)	%
Pain	57	90.5
Numbness	18	28.6
Swelling	6	9.5
Stiffness	4	6.3
Others	2	3.2

Note: A worker may have more than 1 symptom.

**Table II – Type of symptoms by site**

Symptoms	Site	No (%)
Pain (n = 57)	Neck/Shoulder	27 ( 47.4)
	Upper Limb	39 ( 68.4)
	– Arm	9 ( 15.8)
	– Forearm	6 ( 10.5)
	– Hand/Wrist	34 ( 59.6)
	Others (back, chest, trunk)	19 ( 33.3)
Numbness (n = 18)	Upper Limb	18 (100.0)
	– Hand	16 ( 88.9)
	– Forearm	2 ( 11.1)
Swelling (n = 6)	Upper Limb	6 (100.0)
	– Hand/wrist	6 (100.0)
Stiffness (n = 4)	Upper Limb	4 (100.0)
	– Hand/wrist	4 (100.0)

Note: A worker may have more than 1 affected site.

#### Comparison of workers by symptoms

The number of workers who expressed work dissatisfaction was significantly higher among those with symptoms than those without symptoms (63.5% compared to 12.5%,  $p < 0.001$ ). There was no significant difference in age, marital and educational status, race and shift session between workers with symptoms and those without symptoms. There was no correlation between symptoms and the number of stators handled, the number of children less than five years old in the family and the amount of housework done by the workers.

When symptoms were classified as mild or severe, we found that only 27 out of the 79 subjects studied had "severe" symptoms giving a prevalence of 34%. Severe symptoms were defined as those which were present for 15 or more days over the past one month and which either required treatment or affected the workers'

daily activities. When those with severe symptoms ( $n = 27$ ) were compared with those with mild or no symptoms ( $n = 52$ ), two significant differences were observed. Those with severe symptoms handled more stators on the average (mean number of stators handled: 546 vs 396,  $p < 0.05$ ), and they also expressed more work dissatisfaction (% dissatisfied: 74.0% vs 42.3%,  $p < 0.03$ ).

To further evaluate the correlation between lifting and severity of symptoms, an analysis by the nature of work done at their workstations was carried out. Of the 79 subjects, 22 were utility operators who rotate workstations to relieve duties. These were excluded from this part of the analysis leaving 57 operators who were permanent on the job.

The 20 workstations were classified into those requiring manual lifting and those with little or no lifting of stators (ie stators are slid or are being repaired). Table IV shows a significant correlation between lifting of heavy stators and severity of symptoms.

**Table III – Severity of symptoms among workers**

Workers	No	(%)
No. with symptoms	63	100.0
No. who had symptoms daily (last 4 weeks)	26	41.3
No. seeking treatment/self medicated	43	68.3
No. whose daily activities affected	24	38.1
No. who took medical leave	6	9.5

**Table IV – Correlation between lifting and severity of symptoms**

Work stations	No. of subjects	No. (%) with severe symptoms
Stations with lifting	42	18 (42.9)
Stations with little or no lifting	15	1 ( 6.7)
Total	57	19 (33.3)

( $p < 0.05$ )

#### Comparison by shift

While the letter to the union was signed by only those in the morning shift, the prevalence of complaints was not significantly different among workers in the two shifts (85% and 74% in the morning and afternoon shifts respectively). This was not surprising as the nature of the work was similar.

The relative "reluctance" of the afternoon shift to complain was shown by the significantly lower reporting rate. Sixty-three per cent of the morning shift workers had reported their complaints to their supervisors/company nurse as compared to only 21% of the afternoon shift workers ( $p < 0.01$ ). This low reporting rate could be attributable to several significant differences between the workers in the two shifts.

The morning shift workers were significantly younger ( $29.5 \pm 7.9$  year vs  $34.2 \pm 9.2$  years,  $p < 0.02$ ), being in employment longer in this factory ( $63.0 \pm 53$  months vs  $31.3 \pm 46$  months;  $p < 0.01$ ) and were more dissatisfied with their work (73.2% vs 31.6%;  $p < 0.001$ ) than the afternoon shift workers (Table V). No significant difference was found in the two shifts in terms of educational status and marital status, race, number of children less than 5 years old in the family.

The average number of stators handled per shift per worker was not also significantly different (511 and 416 respectively). There was also no significant difference in the severity of their symptoms (as defined earlier).

**Table V – Significant differences between morning and afternoon shift workers**

Factors	Morning Shift	Afternoon Shift	Probability test
Age (Years)	29.5 ± 7.9	34.2 ± 9.2	< 0.02
Employment (Months)	63.0 ± 53.0	31.3 ± 46.0	< 0.01
Dissatisfaction with work	73.2%	31.6%	< 0.001

Note: 1) Morning shift workers were all Singaporeans with previous working experience handling lighter stators in this factory.

2) Afternoon shift workers had no previous working experience in this factory and 50% of them were Malaysians.

### Clinical signs

Clinical examination of all the workers were normal. No neurological deficits were detected in the upper limbs of the 27 with "severe" symptoms. However, 3 had ganglions on the wrist, 6 had callositis on the hands/fingers and one had swelling of both wrists.

### DISCUSSION

Work-related musculoskeletal aches and pains were recognised as a major source of disability in industry and commerce<sup>(1-4)</sup>. In this study, about 80% of the workers had complaints of pain, numbness, swelling or stiffness affecting mainly the hands, wrists, neck and/or shoulders. This prevalence was comparable to a study on sewing machine operators (95%)<sup>(5)</sup> but was somewhat higher than the prevalence rate of between 6 and 53% in studies on other occupational groups<sup>(4,6-8)</sup>. The difference in the prevalence rate reported could be due to differences in the terminology used, screening methods and the levels of symptom severity. When workers with significant symptoms were defined, the prevalence rate fell to 34%, which was comparable to studies on other occupational groups<sup>(4,6-8)</sup>. The prevalence of such symptoms in Singapore is unknown indicating the need for more research in this area.

Dissatisfaction with work was found to be the major contributory factor in the reporting of symptoms in our study group and in a few studies<sup>(8-10)</sup>. Although the prevalence of musculoskeletal symptoms was not significantly different among workers in the two shifts doing the same type of work, there was a significantly lower reporting rate from the afternoon shift workers. This lower reporting rate to their supervisors/company nurse may be due to various factors, such as, stronger work ethic, the fear of losing their jobs and better pain tolerance as these afternoon shift workers were much older, had no previous job experience and 50% were 'guest' workers from neighbouring countries.

The upper limbs, neck and shoulders were the most common sites affected. This was an anticipated relation to the work and was consistent with a study on 152 females assembly line packers in a food production factory where the nature of work also involved mainly lifting<sup>(6)</sup>. Clinical signs were essentially normal in the 63 workers with symptoms. This was expected as the common manifestation of an occupational musculoskeletal injury is pain which may not be accompanied by any objective signs. The finding of ganglion on 3 workers may not be significant as these conditions are quite common among the general population. The 6 workers who had callosities on their hands/fingers pointed

to the demand from repetitive lifting of heavy stators (5.7 kg each). We were therefore convinced that their symptoms were work related based on the strong correlation between the number of stators lifted and severe symptoms and the exclusion of non-occupational rheumatoid arthritis and pre-existing musculoskeletal problems prior to working in this factory. While our cases matched fairly well with the clinical entity of repetitive strain injury, overuse syndromes, cumulative trauma disorders<sup>(11-13)</sup>, the term 'work-related musculoskeletal disorders' is preferred in this study as the contributory factors included not only repetitive, forceful movements but also work dissatisfaction and lifting of stators, particularly, the heavier model.

Recommendations were made to the factory to redesign individual workstations to minimise or eliminate lifting of stators, to introduce job rotation and to train workers on proper lifting techniques. A revisit to the factory in 1991 showed that the lifting of stators was greatly reduced in almost all workstations by aligning the conveyor belt to the same level as the workstation bench allowing them to be slid instead. Bearing holders were also used to facilitate the sliding of stators. The workers had no further complaints. This confirms our belief that musculoskeletal problems can be prevented by paying attention to work procedures/practices and through improvised workstation and work tools. With more mechanisation and a younger and better educated workforce, the impact of musculoskeletal problems may be substantial. We have learnt from this experience, that there is a need for a co-ordinated approach to awareness, diagnosis, management and prevention to reduce such unhappy chain of events, discomforts and work inefficiency.

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