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**OCCUPATIONAL OVERUSE SYNDROME AND
PSYCHOSOCIAL STRESSORS IN THE WORK PLACE**

A thesis presented in partial fulfilment
of the requirements for the degree of
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ABSTRACT

There is continuing concern about the incidence of Occupational Overuse Syndrome among workers using keyboards in New Zealand, but very little local research into the possible causes of the syndrome. Following results from overseas research, it is hypothesised that differences in rates of pain reporting by keyboard workers are related to job stress caused by different levels in the quality of the work environment. An interaction between autonomy and work pressure is also hypothesised. Keyboard users in several different job types, working in eight different newspaper offices of the same newspaper company, were surveyed. The results confirmed the hypotheses. Post hoc analysis showed that there were important differences between the types of stressors that predicted pain reporting between offices, and those that predicted pain reporting between job types. These results confirm the importance of considering psychosocial factors in work and workplace design for the prevention of OOS. Conclusions are also drawn about the situation specificity of such empirical research, and the need for more theoretical work in the search for the aetiology of OOS.

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INTRODUCTION

1.1 THE NATURE OF OOS

Occupational overuse syndrome (OOS), is one of many descriptions of work related musculoskeletal problems of the upper limbs and body. Other terms used to describe the general condition are : repetitive strain injury (RSI); cumulative trauma disorder (CTD); occupational cervicobrachial disorder (OCD); repetitive motion injury (RMI) and regional pain syndrome. OOS is the term now recommended by the Occupational Safety and Health division of the New Zealand Department of Labour (Wigley et al., 1992), and that which is used in this study. The multiplicity of names reflects the present difficulties in medically defining OOS, and the many controversial aspects that surround the description, diagnosis and aetiology of the condition.

People with OOS may experience a variety of symptoms including pain, fatigue and weakness in some or all parts of the upper limbs, shoulders and back. Physical signs such as local tenderness, swelling, hardening or crepitus (crackling), may or may not be present (Bammer & Blignault, 1987). The symptoms have been classified into five progressive stages (NOHS, 1985; Stone, 1984), or three stages (Browne, Nolan, & Faithfull, 1984). Stage one is characterised by pain and fatigue at work. In stage two there is recurrent pain which occurs at work, persists for longer and may be accompanied by physical signs. Stage three is indicated by persistent pain and weakness in other activities and at rest, including sleep disturbance, and physical signs are present. Under these classifications (which are arbitrary and often questioned in the literature), it is understood that in the early stages the condition is reversible, but beyond a certain point, not so easily, so that early intervention or preferably prevention is important. (Wigley et al., 1992; McLean, 1988).

The consequences of developing OOS can be "more than a pain in the arms" as detailed by Bammer and Blignault in a 1988 review. In the extreme cases "severe pain and other symptoms may persist for years with concomitant disability. In addition, syndromes may be associated with anxiety and depression, social withdrawal, damage to career prospects, and involvement in protracted legal action." (p.394).

A distinction has been recognised between two types of OOS: the well known clinical entities with demonstrable localised symptoms, such as occupational myalgia, fibrositis, ganglion, carpal tunnel syndrome, bursitis, tendonitis, or tennis elbow. Secondly, an "ill-defined disorder" (Mullaly & Grigg, 1988), described as: "Diffuse muscle discomfort, pain, burning and/or tingling; with identifiable areas of tenderness in muscles..." (Wigley et al., 1992, p.11.). In this type there is no identifiable degeneration or inflammation and there is general agreement that features such as heat, swelling and crepitus are unusual (Bammer & Martin, 1988). Littlejohn and Miller (1986) also classify a third type, in which a clinically described entity has developed into a chronic pain disorder. It is the second type of OOS, with a diagnosis based on reported pain that can become chronic and permanently disabling with severe social and psychological consequences, that has become the focus of confusion and controversy. The most public and professional controversy centres on the increases in OOS in female keyboard workers (Kiesler & Finholt, 1988), and has been fuelled by a medical model that assumes that physical pathology does not exist where observable signs are not present.

1.2 INCIDENCE AND PREVALENCE OF OOS.

In 1700 Ramazzini gave the first recorded description of an OOS type disorder (McDermott, 1986). He believed that injuries in clerks and scribes were caused by repeated use of the hand, a constrained sitting position and excessive mental labour. In 1977 Maeda reviewed the prevalence and causative factors of OOS (called cervicobrachial disorder in Japan) and came to a similar conclusion:

excessive workload related to the disorder "...includes both localised muscle loading and mental strain."

The differences in defining, naming and measuring the degree of different incapacities make it difficult to compare studies of incidence and prevalence. The diffuse forms of OOS (often called writers cramp) have been recognised in a variety of occupations and reported widely in the medical literature since Ramazzini's treatise (Bammer & Blignault, 1987). "Tenosynovitis" was first reported by Velpeau in 1825 (McDermott, 1986), and has become commonly reported in this century. It has been stated that "tenosynovitis" has been the second most common industrial disease in the United Kingdom since 1977 (Fry, 1986).

The international literature yields studies of OOS type problems in Britain, Germany, Denmark, Finland, Sweden, France, Holland, Switzerland, Japan, the United States, Canada, and Australia. These reports are associated with a wide variety of occupations, including assembly or process workers, VDU operators, typists, accounting machinists, cash register operators, sewing machinists, butchers and meat packers, carpenters and musicians (Bammer & Blignault, 1987; McDermott, 1986; Mullaly & Grigg, 1988).

Between 1960 and 1980, an epidemic of occupational cervicobrachial disorder was reported in Japan (McDermott, 1986). First noticed among key punch operators in the 1950s, the syndrome was found to affect typists, telephone operators, office keyboard operators, cash-register operators and process workers (Maeda, 1977).

1.3 THE AUSTRALIAN EXPERIENCE.

The syndrome became a major source of concern in Australian industry in the 1980s, where it was described as "the 'new' industrial epidemic" (Ferguson, 1984). Australia's incidence of OOS (usually referred to as RSI) in factories and

particularly in female keyboard workers is extremely high by international standards, even though there is evidence (e.g. Wallace & Buckle, 1987) that the figures reflect under reporting of the problem.

In several Australian studies of women doing keyboard work, the percentage with diagnosed RSI ranged from 10% to more than 50%. In New South Wales nearly half of all workers compensation claims by women in the early 1980s were for RSI with yearly increases, and in Victoria, RSI claims for women for 1985 accounted for 62.5% of claims (Kiesler & Finholt, 1988). By the same year OOS categories represented 19.4% of new male compensation disease cases in NSW, and 82.7% of new female compensation cases (Meekosha & Jakubowicz, 1986). More details of OOS statistics for this time may be found in Willis (1986) and McDermott (1986). By 1987 the rate of claims for OOS type injuries had begun to decline and: "The consensus of informed opinion is that the worst of the epidemic has passed." (Hall & Morrow, 1988).

Public attention was focused on the problem in the mid 1980s mainly through newspaper articles with headlines such as: "RSI, the Billion Dollar Riddle" (Hall & Morrow, 1988); "The RSI Epidemic: Technology Spawns Its Own Disease" (Quinlan & Bohle, 1991); or, "Hi-tech Epidemic: victims of a bright new technology that maims" (Willis, 1986). Thus the acronym, RSI, and the possible consequences of upper limb pain, became familiar to the general public. This awareness has certainly travelled to New Zealand, where RSI is still the familiar term and most people are aware of its application.

1.4 OOS IN NEW ZEALAND.

Apart from the dramatic developments of the Australian experience, OOS continues to affect worker's lives throughout the world, including many in New Zealand, where it is still making headlines, ("RSI: The silent epidemic", More Magazine, 1991; "Facing hi-tech pain", Evening Standard, 1992; "Like a bad

headache that won't go away", The Dominion, 1992; "Backtrack on compo for rsi victims", The Dominion, 1992).

The most common occupations of workers receiving Accident Compensation Commission (ACC) payments in 1990 were, shearers, factory labourers, general typists, slaughtermen and butchers, and shop assistants. In the financial year ending March 1990, \$NZ12.7 million was paid out in compensation to OOS cases. That amount does not include payments made on continuing claims from previous years (Kennedy, 1992).

Recent ACC figures show that OOS among office workers in particular is not declining. There were 236 OOS claims registered in the 1990 financial year for office workers. 229 of these were for females and 7 for males. In the 1991 financial year, 291 claims were registered: 266 by females and 25 by males (ACC unpublished statistics, 1992).

As in Australia, the compensation statistics probably reflect only a small proportion of actual incidence of the problem. There is very little published research in this area but many indications that the problem is common and that much goes unreported, undiagnosed, or untreated. A young VDU operator interviewed in a Palmerston North office said that her doctor had diagnosed her pain as RSI but told her that there was nothing that she could do about it apart from giving up her job. The arm splint that she wore had been given to her by her supervisor, who had suffered from the same complaint for years. This could be a common sort of experience for many more OOS sufferers. In 1988 the Distribution Workers Federation executed a survey to provide data relating to retail workers and OOS, because of the lack of information needed to deal with concerns about increasing numbers of OOS sufferers in the union, and reports of inappropriate diagnosis and treatment by GPs (Brown et al, 1989). The results showed a high annual prevalence of shoulder and wrist/hand symptoms (36% - 50%), among meat packers, shelf fillers and checkout operators. As part of the same survey, 17 females took part in a medical verification of their symptoms by

an Auckland specialist. Although seven had taken time off work under the aegis of ACC, all reported that they had received no information from their employers or their union about their ACC rights. The specialist was also dismayed to find that only five of the group had been given any kind of diagnosis for their pain problem by their respective GPs and sometimes this was fatuous, e.g. "old age" (p.42).

There is a paucity of data relating to the prevalence of OOS among New Zealand office workers apart from compensation statistics. A small survey of one hundred VDU operators in government and private offices, undertaken by OSH in 1984, revealed that 54% of 75 data entry and data process operators suffered from "postural" health effects. The most common postural effects reported were aches in the shoulders and upper arm, (the second most common being lower back aches, and the third, neck and upper back). Nine of these operators had sought medical treatment. One reported that her personality had changed because of pain caused by her work at the VDU, and another said that she had curtailed athletic training because of shoulder pain (Darby, 1984). At this time the researchers were not concerned with OOS (it was not mentioned in the study) but mainly with the ergonomic design of workstations. However, there are important possible effects of the work situation itself revealed in the operators' health indices.

More current effects are indicated by the interest of large organisations. The Inland Revenue Department has recently sought the advice of an ergonomist because of the incidence of OOS among VDU operators. Management, health workers and unionists are concerned about the prevalence of OOS among VDU operators at Independent Newspapers Limited (INL) since the introduction of new technology.

1.5 AETIOLOGY OF THE SYNDROME

Because of the epidemics in Australia and Japan there has been much discussion, speculation and some research into the causes of OOS which remain largely unknown. Much of the debate has come to focus on the causes of the "epidemic" and this emphasis is not appropriate to the New Zealand situation, except that many attitudes and aspects of the debate have crossed the Tasman and necessarily affected thinking in New Zealand. For example, recent letters in the New Zealand Medical Journal quote opinions expressed previously in the Australian medical literature (Welch, 1990; Wigley, 1990b). Some warnings can also be taken from the Australian experience in hindsight. OOS among office workers (particularly VDU operators) is the focus of the Australian debate, and the concern of the present study, so that this area is emphasised in the following discussion.

The debate over the aetiology, epidemiology and social meaning of OOS in Australia has several major perspectives, presented alone or in different combinations which reflect the pragmatic or political viewpoint of the protagonists. Bammer and Martin (1988) show in a detailed review, how each proponent ignores the other arguments, although many have some aspect to contribute to further exploration. The various proffered explanations for the causes of OOS may be considered within the following arbitrary categories: medical/biomechanical; no injury (malingerers); psychiatric; other worker characteristics; sociological; psychosocial; the multifactorial approach.

1. Medical/biomechanical

The view that the causes of OOS lie in the work situation and work practices, includes the medical perspective that OOS is a somatic disorder and should be treated as such. The underlying theory is that OOS is a disorder caused by repetitive movements or extended static loading in the workplace. The diffuse muscle disorders have not been clearly linked to an underlying pathology,

although possible mechanisms have been suggested (e.g. Browne et al., 1984; Edwards, 1988; Owen, 1985).

The results of this view are an emphasis on the ergonomics and organisation of work practices as solutions to the problem. Following a review of current studies in Japan, Maeda (1977) recommended that preventive measures should include:

- 1) ergonomic improvement decreasing localisation of work load;
- 2) improvement of the length of work spells, working hours, and rest periods;
- 3) limitation of the work speed and output per day;
- 4) revision of the work control system so as to allow the workers spontaneous rests. (p.201)

In 1984, Browne, Nolan and Faithfull made similar recommendations for the reversal of "stage 1" RSI symptoms:

1. The identification of risk factors in tasks, equipment and work environment.
2. The reduction of work rate and the cessation of bonus and overtime incentives.
3. Work variation - alternation of repetitive with non-repetitive tasks at regular intervals.
4. Rest breaks and muscle stretching exercises at regular intervals. (p.331).

The Task Force Report (Australia, 1985) and the National Occupational Health and Safety Commission (NOHSC) report (1986) both endorse the same recommendations and ACC guidelines in New Zealand follow a similar line.

However empirical evidence for the success of ergonomic and work organisation improvements alone is scarce. Although there is a great deal of support in the literature for the basically ergonomic conceptualisation of OOS (cited in Mullaly & Grigg, 1988), most findings are not well supported. Mullaly and Grigg isolate eight studies that give "...patchy support to the link between posture and pain...", but overall the research does not support the existence of a distinct clinical entity that is progressively staged, nor explain the potentially chronic nature of that pain. (p.26)

A study published in 1991 by Sauter, Schleifer and Knutson reported that few of the ergonomic variables tested were significantly related to the wrist, neck and shoulder pain that was prevalent in a sample of several hundred VDT users in the United States. They also quote several recent studies on exercise and rest breaks which do not yield sufficient data to allow firm conclusions regarding the outcomes of these strategies.

Furthermore, there are epidemiological aspects of the syndrome that do not sit comfortably within a somatic injury explanation. For example, the incidence of RSI in Australia varied widely between government departments, including the same government department in different states, and between companies in private industry that used the same equipment (Hall & Morrow, 1988). Also, the expected cause and effect relationship did not appear in Hocking's (1987) report on the incidence of RSI in Telecom, Australia: the prevalence of pain was inversely related to the rates of key-stroke in three different occupational groups.

Despite the lack of empirical support the medical /ergonomic model has dominated the approaches to the management of RSI (Quinlan and Bohle, 1991). Many employers have adopted ergonomic approaches with good intentions, only to find that the problem remains.

Such contradictory evidence combined with medical scepticism, has led to a proliferation of alternative explanations.

2. Malingering.

One reaction to the absence of an apparent organic basis to pain is to deny that the syndrome exists. In Australia this reaction has been linked with the compensation claims of victims and racist stereotypes to engender dismissive epithets such as "golden wrist", "migrant arm", or "kangaroo paw" (Bammer, 1987; Willis, 1986).

Awerbach (1986), one of the main proponents of this view in the Australian medical literature claims that : "The medical profession is well aware of the dangers of the labelling of "non-disease", a practice that causes patients to perceive of themselves as ill and which may result in a more pervasive illness." (p.363). The view that the injuries are simulated is still held by some New Zealand medical practitioners and has been quoted recently in the New Zealand Medical Journal by Welch (1990) who says that: "Patients present with preconceived ideas fuelled by media hype and the availability of compensation for people in boring jobs."(p. 435).

3. Psychiatric Explanations.

Denial of the diagnosis notwithstanding, people continue to suffer and present with upper limb pain. Other explanations of the syndrome's unknown organic pathology include "occupational neurosis" (Meekosha & Jakubowicz, 1986) and "compensation neurosis" (Bammer & Martin, 1988; Hopkins, 1987). These labels are poorly defined and supported but suggest that there is a subconscious desire to escape work that is expressed through OOS as a legitimised mechanism. This view is not supported by the clinical observations of medical specialists (Hight, 1990; Turner, 1990; Wigley, 1990a), nor with the observations of researchers such as Fry (1986), who notes that OOS has been diagnosed with confidence in highly motivated groups, such as musicians. Furthermore, there is evidence that this view exacerbates the psychological consequences of having OOS (Bammer & Blignault, 1988; Meekosha & Jakubowicz, 1986).

Lucire (1988) argues that there is no injury at all but a form of "conversion hysteria", in which underlying conflicts or needs are converted to physical symptoms. The manifestation of the particular symptoms is encouraged by suggestion, hence the epidemics in certain workplaces where the belief in injury is reinforced by medical diagnosis, union and legal support. Lucire believes that compensation and attention through physical therapy is damaging because it

clouds the real psychiatric disturbance. Although Lucire's views were widely publicised, the hysterical conversion hypothesis has been refuted in contemporary critiques (Hall & Morrow, 1988; Hopkins, 1989; Mullaly & Grigg, 1988).

4. Other Worker Characteristics.

Another way to explain the different reporting rates is that certain personality types are prone to musculoskeletal disorders. Nall and Thomas (cited in Mullaly and Grigg, 1988) found that OOS sufferers were more likely than controls to show high Type A and anxiety scores. These findings are not conclusive but are consistent with observations of patients by medical practitioners in New Zealand (e.g. Wigley, 1990a; Hight, 1990). Many doctors report that their patients are not malingerers but highly motivated to work, perhaps too highly.

Noting the very high percentage of women in the compensation statistics, most commentators are content to ascribe this to the higher proportion of women in the occupations affected (e.g. factory floor and office work). Champion, Cornell and Browne (1986) made clinical observations of 100 consecutive cases and suggested that the high proportion of women seen (89%) was a reflection of not only job selection, but "...weaker muscles, a narrower interscalene triangle, and greater descent of shoulders during development." (p. 111). In New Zealand the statistics support the general view that sex as a correlate of OOS is confounded by job selection. Although the greatest number of OOS claims among office workers were by women, the ACC statistics for 1989/90 show that claims for work injuries, in which the injury contact was repetitive movement, totalled 3,909 (\$NZ8,038,814): 2,055 of these claims were by men and 1,854 by women. This is explained by the higher numbers of claims by shearers and meat workers - male dominated occupations.

5. Psychosocial Causes.

An explanation that accepts the reality of the pain but explains some of the anomalies in the epidemiology of the disease is that the work and social environment can be a causative factor. This explanation is usually considered in conjunction with somatic and ergonomic explanations, and has been well accepted owing to supportive evidence.

As noted above, both Ramazzini and Maeda included mental strain as causative factors. The Task Force Report (NOHSC, 1986) associated incidence of OOS with the social context of work, attitudes to the job and stress in the working environment. Keisler and Finholt (1988) hypothesise that OOS is really related to bad work conditions and an unfulfilling work life. They claim that the present emphasis on biomechanical factors and individual level variables is misdirected and that the quality of work life underlies the "RSI dilemma". Mullaly and Grigg (1988) quote evidence that relates stress in the work place to musculoskeletal symptoms and suggest pathways through which stress and anxiety could cause OOS. They suggest that the pain shown to be caused by poor posture and static muscle load could become a psychosomatic disorder, and call for open mindedness about the contribution of physical and psychological factors. The empirical evidence that supports this view (e.g. Blignault, 1985; Hopkins, 1990; Ryan and Bampton, 1988; Spillane and Deves, 1988; Wall, 1985) will be examined in the following section.

Commentators such as Willis (1986), Hall and Morrow (1988) and Hopkins (1989) have used a sociological perspective to explore the wider social aspects of the problem. Willis in particular contends that the personal troubles of OOS sufferers must be linked with the public issues that surround the injury. He does not discount the objective reality of the pain, nor the physiological and ergonomic aspects, but adds that there is a substantial social aspect that needs to be explained: "The social environment...,mediates the effects of the physiological and

ergonomic factors." (p.211) Willis believes that this aspect must be included in the context in which empirical investigation proceeds.

One aspect of the debate that is relevant here is the tendency for the arguments to be polarised into support for blaming the worker versus those that emphasise faults in the workplace. This division is emphasised in Australia and other countries where there is an adversarial system of compensation (see Hopkins, 1987). The interests dividing this debate are factions such as unions, the women's movement and the worker's health movement on one side and insurance companies and employers on the other. Willis (1986) demonstrates that these arguments are part of a continuing negotiation over the socio-political meaning of the syndrome.

New Zealand has a no fault public insurance scheme (ACC) which should ameliorate these divisions, however there are still aspects of the same polarisation. Hadler (1986) shows that the no fault scheme is subject to mounting costs and explains the basis of social and medical concern. Workers in New Zealand do not have to contend with litigation but must still face medical scepticism and ACC reviews when their compensation is denied, leading to arguments about the nature of their complaint and its causes (Turner, 1990a; Turner, 1991a; Turner, 1991b). Recent changes in ACC legislation could exacerbate this situation.

The unfortunate result of this sort of debate is an emphasis on certain causal aspects (e.g. unions want improvements in the work place and are sensitive to suggestions of individual responsibility; insurers are responsive to suggestions that the worker is to blame) which works against a consideration of a combination of causes.

However there is a growing call for a comprehensive multifactorial perspective and evidence to support this view.

6. Multifactorial Aetiology.

Bammer and Martin (1988) conclude that the issues arising from the OOS debate may provide the necessary stimulus for the "...need to develop and expand upon frameworks of thinking in which the inherent complexity of natural systems can be accommodated." (p.355). Ryan and Bampton (1988) postulate a multifactorial aetiology in which posture, work organisation and work social climate are all implicated. In 1986 some members of the medical profession were already advocating this view. In a letter to the Medical Journal of Australia, Price and his associates cited existing recognition and knowledge of the relationship of psyche and soma and called for a holistic, multidisciplinary approach. In 1987 Liddicoat and Ellis of Worksafe Australia commented on a growing recognition, reflected in current practical approaches to treatment, of psychological and social causes. Several published reports of interventions in the occupational health field, attest to the success of a broader approach to the problem (McLean, 1985; McGraw, 1985; Meyer, 1987; Rowe, 1987;). The New Zealand Occupational Safety and Health Treatment Guidelines (Wigley et al., 1992) recommend a multiple aetiology approach, although the contributions of the ergonomic, work load, personality and social environment factors is still unclear.

Accordingly, as part of a broader investigation of the relationship of ergonomic factors, personal behaviour attributes, and quality of work life to upper limb pain reporting, the present study will examine the psychosocial environment of the workplace and its correlates to OOS.

OOS AND THE QUALITY OF WORKING LIFE

2.1 PSYCHOSOCIAL CORRELATES OF OOS

Observations that the sudden increase in musculoskeletal injury in Australia was related to the introduction of visual display technology into the workplace (Bammer, 1987; Keisler & Findholt, 1988; Williams, 1986) is pertinent to the focus of this study. Since the introduction of word processing equipment into offices at Independent Newspapers Limited (INL) in the 1980s the increase of OOS complaints have caused concern to management and unions. Before the introduction of the new equipment the management was aware of potential problems. A general manager and a union representative travelled to Australia for advice in choosing well designed equipment. In spite of this foresight there was an alarming incidence of OOS over the twelve months following the introduction of word processors. Ergonomic and occupational health consultants were called in to assess the problem, resulting in further recommendations for improvements in the use of the equipment and the appointment of a permanent Occupational Health Nurse (J. Beek) who has instituted a programme of education and monitoring of sufferers. The interventions of Ms Beek have resulted in improved rehabilitation and the reduction of work time lost, but she reports that she still sees approximately one new case a month. This is not an isolated experience (Quinlan & Bohle, 1991) and reinforces the insufficiency of a purely physiological approach to the problem of cause and prevention of OOS.

At INL Ms Beek has noted that some cases are linked with obviously stressful situations such as the Gulf War (when newspaper workers were under extreme pressure), announcements of redundancies, and times of reduced staff numbers (when workload increases). She has also noted that special groups, such as compositors (whose work load is such that they never finish) or all night staff, are in more stressful situations that could be linked with their symptoms. These

observations suggest that psychosocial factors such as stress should be investigated. It is also likely that there are other stressful aspects of the workplace besides the obvious and dramatic. There are several empirical studies that have demonstrated the importance of stress in the work environment in relation to VDU work and OOS.

Japanese studies have identified stress factors in the workplace as being a major contributing factor (NOHSC, 1986), and there is evidence in more recent Australian studies that psychosocial factors are related to increased incidence of OOS. The first of these (Smith, Cohen & Stammerjohn, 1981) examined the effects of VDU use on a number of health outcomes. Three groups were used: clerical VDU operators, professional VDU operators and clerical workers using typewriters and card indexes. The clerical VDU workers had significantly higher levels of musculoskeletal (mainly muscular) and emotional problems than the other two groups. The important psychosocial stressors included, low peer cohesion, low job autonomy, lack of control over job activities, less involvement, less staff support, boredom, greater workload dissatisfaction, more concern over career development, and lower self-esteem. The findings that, while clerical VDU users reported the highest stress levels, professional VDU users reported the lowest stress levels and the clerical non-VDU users were in the middle, suggest that VDU use is not the only factor contributing to job stress levels and health complaints, but other aspects of job content make a contribution. Smith and colleagues noted that VDT use among clerical workers decreased feelings of control over the pace of work, although the workload was no higher than that of non-VDU users.

Blignault (1986) examined the specific links between OOS and psychosocial aspects in a study of three groups of VDU operators at two places of work: 44 machine compositors, 65 data processing operators, and a mixed group of clerical staff. Comparisons were made between those with frequent symptoms and those with no symptoms on several variables. The risk factors for OOS symptoms, identified through multiple regression analysis using these variables, were :

keyboard duties only, high work pressure, low peer cohesion, low autonomy and pushing oneself.

In a similar study of 144 operators in three government departments, Wall (1986) found that seven variables accounted for almost 70% of symptom occurrence. These were : competitive in work, submissive, not enough time to take rest breaks, introverted, frequent deadlines, perfectionist, and the belief that urgent work is not really essential. This last variable is related to the other aspect of Wall's work. She compared authors' (the people who gave the typists the work) perceptions of the work environment and its demands, with that of the keyboard operators' perceptions and found that while they commonly agreed on quantitative aspects of the work and their potential as risk factors (e.g. poor training, deadlines, overtime) the authors had no perception of other psychosocial aspects of the work environment conditions such as the control operators have over their work, or the stress involved in keyboard work.

Ryan and Bampton (1988) surveyed a group of 143 data process operators and found frequent and characteristic symptoms. They selected 41 operators with very high symptom scores to compare with 28 with very low symptoms on a wide range of variables. They found no differences on individual characteristics (although these did not include personality related variables), and only one difference in the physical environment (visual glare). Significant differences for the group were found in: posture; missed work breaks and perception of time for work breaks; stress at work; feeling bored; pushing oneself; low peer cohesion; higher staff support (an anomalous finding in terms of causal expectations); low autonomy; higher work pressure; and low clarity. These results led Ryan and Bampton to postulate a multifactorial aetiology in which posture, work organisation and work social climate are all implicated, with the greatest weight being given to social and psychological factors.

Continuing the quest for evidence of multifactorial causes, Green and Briggs (1990) analysed factors associated with symptoms of OOS and compared the

results to those reported in previous studies. Using two random samples of 40 sufferers and 40 non sufferers from an initial survey of university staff VDU users, a discriminant function analysis correctly identified 79% of the sufferers. The discriminating variables were: formal typing training; superior typing ability; poor peer cohesion; high peak keyboard hours; high involvement; low autonomy; high work pressure; and low supervisor support. Although the keyboard hours were often higher than recommended and the onset of symptoms is related to keyboard hours, there was no relationship found between severity of symptoms and hours of keyboard use. It was noted that some job categories had higher keyboard hours but lower prevalence of symptoms: these jobs tended to be those with more autonomy and less monotony and pressure for the operator. Nevertheless the major discriminating factors (typing training and ability) were directly related to number of keyboard hours because those individuals would have jobs that are mainly typing. An anomalous finding reported was that less involvement (not high involvement as here) is commonly reported by operators with a higher prevalence of musculoskeletal disorder. Overall Green and Briggs found that their results were similar to the earlier studies and supported the multifactorial nature of the problem and the importance of work environment and job characteristics.

From Sweden a study of 438 medical secretaries and office personnel (Linton & Kamwendo, 1989) found that there was a three fold increased risk for neck and shoulder pain for those experiencing a poor psychologic work environment. In particular, work content and social aspects of work were found to be influential (similar to the Green and Briggs, 1990 finding) and to a lesser degree, work demand was related to the discomfort complaints.

There are several problems with the approach to the aetiology of OOS that is exemplified by the studies discussed so far. In looking for causal directions, empirical evidence from cross sectional studies is insufficient because there is no indication of which variable is cause and which is effect. Although some authors suggest possible pathways (e.g. Green & Briggs, 1990; Ryan & Bampton, 1988)

there is as yet no sound theoretical framework to give coherence to empirical findings and consequently the research has proceeded in a heuristic mode, with empirical results of cross sectional designs suggesting further hypotheses.

However, as the basis for such a progression, studies such as those cited above are seriously flawed by confounding from the use of subjects who have the complaint; i.e. the diagnosis and effects of suffering from OOS could also be correlated with the independent variables. For example, Ryan and Bampton (1988) found that contrary to other findings the OOS group reported higher staff support. This could well be because, as working OOS sufferers, these individuals received more supportive attention from supervisors. Thus it would be possible to derive at least two interpretations from the results of such studies: psychological and social problems at work are leading to OOS symptoms; or the conditions of work are seen as difficult because those workers who report problems are affected by their pain.

Spillane and Deves (1987) have a third possible explanation of OOS and work conditions in terms of a "pain-patient model": workers who experience pain are encouraged to become patients under the existing social conditions. An empirical study (Spillane and Deves, 1988), of 690 employees of a large manufacturing organisation, compared diagnosed OOS sufferers (11%) with a non-OOS group across three job types (management, white collar and blue collar) and several work environment and personal factors. The results of the comparisons, which support the relationship of psychosocial factors to OOS, are interpreted on the basis of this model and they suggest that "...occupational pain is an inexorable human condition, but the observed differences in reporting pain are contingent upon the influence of psychosocial factors." (p.26)

Spillane and Deves begin with a theoretical explanation from a social constructionist view, but their research is subject to the limitations of a cross sectional design that uses subjects who have been diagnosed as having OOS. Thus the results of their study are interpreted in terms of the model but fail to provide empirical support, and many of their conclusions are questionable. For

example, although the results give support to the role of biomechanical factors, Spillane and Deves choose to ignore these factors in the light of significant findings for the psychosocial factors: mood, poor interpersonal relationships and lack of autonomy. Secondly, the results are interpreted as showing that people who have been diagnosed as having OOS are more likely to report upper limb pain and also (to a lesser degree) more likely to report other minor illnesses, which is logically consistent with clinical descriptions of the symptoms and consequences of suffering from OOS. This points to the severe limitations of using subjects who already have the disease. The tautological conclusions drawn from these results would be the same as concluding that people with broken legs are more likely to complain of leg pain and have decided to become patients. Spillane and Deve's conclusions deny any underlying physical reality of the symptoms, beyond everyday aches and pains. The pain-patient model recognises the broader sociopolitical influences but ignores the fact that for some sufferers the intensity of the pain leaves them no choice but to seek medical help and does not take into account the clinical observations of medical practitioners (e.g. Wigley, 1990a). Spillane and Deve's interpretation of positive findings for psychosocial correlates of OOS sees moodiness, poor interpersonal relationships and lack of autonomy as affecting the perception and reporting of pain, not as contributing to its cause. The reporting of OOS then is seen not as a variable to be related to working conditions, but as a measure of work dissatisfaction.

The design of a subsequent study by Hopkins (1990) attends to the problem of confounding. Hopkins narrows the research area to concentrate on the influence of psychosocial factors alone and systematically address the fact that the rates of OOS appear to vary greatly among workplaces that are otherwise similar (as has been previously discussed above). He hypothesises that "the variation in RSI across government departments is related to the variations in the quality of work". (p.131) To test this hypothesis Hopkins surveyed two government departments with three occupational groupings of keyboard operators in each (plus a seventh group of compositors) to measure rates of OOS reporting. Workplace measures were constructed using only responses from those in each office who had not

experienced OOS symptoms. In this way the measures of quality of work were not contaminated by the perceptions of those already suffering from OOS. The differences between the high OOS reporting group and the low OOS reporting group for each occupation were compared on 14 quality of work variables: involvement, peer cohesion, staff support, autonomy, task orientation, work pressure, clarity, control, innovation, physical comfort, subjective stress, boredom, variety, and work satisfaction. For each variable, except work pressure, the differences were in the expected direction; i.e. high OOS reporting workplaces were associated with poor work environment scores. The differences were not statistically significant but Hopkins attributes this to proportional differences between the groups, rather than absolute differences, and suggests that larger samples would achieve statistical significance. This approach is a promising one for further exploration.

2.2 STRESS IN THE WORKPLACE AS A PSYCHOSOCIAL CONSTRUCT

Hopkins (1990) also provides a useful discussion of the construct of stress as a psychosocial factor and its measurement as quality of worklife. He notes that psychosocial environment is a nebulous notion and job stress is subject to contrasting interpretations. Thus an alternative conceptualisation of psychosocial factors is proposed: "as indicators of the quality of work, embodying the presence or absence of occupational stressors." (p.130-131). To measure the quality of work in each workplace (using aggregations of individual perceptions) Hopkins chose the Work Environment Scale (Insel and Moos, 1974) as a measure with the closest links to stress research. This scale provided the first ten factors of the study (see Table 1) which were supplemented by four other standard quality of work questions (job satisfaction, variety, boredom and perceived stress). Hopkins makes a valuable contribution to the line of research, discussed in the previous section, by clarifying the theoretical basis of the construct and its operational definition which will be developed here.

Table 1.
Description of subscales of the work environment scale from Insel and Moos (1974).

1. Involvement	Measures the extent to which workers are concerned and committed to their jobs.
2. Peer Cohesion	Measures the extent to which workers are friendly and supportive of each other.
3. Staff Support	Measures the extent to which management is supportive of workers and encourages workers to be supportive of each other.
4. Autonomy	Assesses the extent to which workers are encouraged to be self-sufficient and to make their own decisions.
5. Task Orientation	Assesses the extent to which the climate emphasises good planning, efficiency and encourages workers to get the job done.
6. Work Pressure	Measures the extent to which the press of work dominates the job milieu.
7. Clarity	Measures the extent to which workers know what to expect in their daily routines and how explicitly rules and policies are communicated.
8. Control	Measures the extent to which management uses rules and pressures to keep workers under control.
9. Innovation	Measures the extent to which variety, change, and new approaches are emphasized in the work environment.
10. Physical Comfort	Assesses the extent to which the physical surroundings contribute to a pleasant work environment.

Quality of Worklife and Health

Quality of worklife research covers a broad, often strongly pragmatic area, with no agreement on theoretical approach or measurement (Davis & Cherns, 1974; Efraty & Sirgy, 1990; Elizur & Shye, 1990; Lawler, 1975; Mirvis & Lawler, 1984). The Insel and Moos Work Environment Scale approaches the measurement of quality of worklife from a basis in theories of stress and its relationship to health, which are the salient concerns of the present study.

According to this approach, the psychosocial environment has a "climate" that may be unique to the people involved and their interactions with one another. Factors relating to a stressful environment have been related to many illnesses including hypertension, peptic ulcers, migraine headaches, dermatitis, obesity, asthma, rheumatoid arthritis, and heart disease (Insel & Moos, 1974), and there has been continuing work based on theories of physiological responses to stress and the implications of stress in the aetiology of illness (Gatchel, Baum, & Krantz, 1989).

Kritzel and Moos (1974) describe the development of the Work Environment Scales to account for the results of studies in this area that showed more variance between situations and settings than between individuals. They also review a large body of evidence to support the view that social environmental factors have pronounced effects on human physiological processes. Rather than using the global label *stress*, they believe that "...it is more fruitful to investigate the specific physiological effects of distinct social environmental dimensions." (p.29)

Measuring the Work Environment

Three basic dimensions were conceptualised to discriminate between the characteristics of different environments:

- Relationship (involvement, peer cohesion, staff support);
- Personal development (autonomy, task orientation);
- System maintenance and change (clarity, control).

Three further dimensions were related to work environments:

- Work pressure; Innovation; Physical comfort.

The dimensions of the WES are matched by the core concepts of the accessible universe of job measures as identified by Kahn (1981), except for pay and promotions which are better considered in the domain of job satisfaction. The ten factors are also directly comparable to psychosocial correlates of OOS identified in previous research.

Kritzler and Moos believe that measurement of *perceived* social climate could provide an important connection between the objective environmental stimulus and the mediating effects on individual physiological responses of differences in personality, perception, coping and defence. Therefore the complex relationships between environmental dimensions and personal characteristics may be included in the measurement and related to physiological indices. The results could be used to provide predictions about adverse environments for particular groups of individuals, or to suggest specific and limited changes in environments in which many individuals suffer from particular symptoms. In this aspect the WES is immediately applicable to the current concerns of OOS research.

A second possibility suggested is that the social milieu may moderate or mediate the physiological effects of other characteristics, in which case direct manipulation of the environment would be beneficial. In the case of OOS this is likely, given that the illness seems specifically related to the type of work being undertaken so

that the effects of the psychosocial environment may moderate the physical effects of the work.

Interactions among Psychosocial Factors

A related approach to stress in the work environment is embodied in the work of Karasek, Baker, Marxer, Ahlbom, and Theorell (1981). They found an association between high perceived job demand (work pressure) and low job decision latitude (control; autonomy) in relation to increased mental strain and coronary heart disease risk. Other studies have shown correlations between workers perceptions of job demand and their psychosocial environment with the development of musculoskeletal symptoms (Ryan & Bampton, 1988). The job strain model proposes combined effects of levels of job demands and decision latitude, which have been already demonstrated in the prediction of mental strain symptoms related to the job, such as depression, sleeping problems and dissatisfaction (Karasek et al., 1981). It is possible that the related factors identified by the WES (control, autonomy and work pressure) have an interactive effect that would have important implications for changes in the work environment.

Another important consideration concerning the content of the construct is the relationship between stress in the work environment and stress that people might bring to their jobs from other circumstances in their lives. In her study of risk factors for OOS, Blignault (1986), found no relationship between life stress and work related illness. This result is supported by the findings of a more detailed study by Klitzman, House, Israel and Mero (1990), who report that work stress and non-work stress have separate effects on health. Karasek (1981) also found that the perception of a demanding job is not likely to result from associations with non-job stressors.

2.3 THE PRESENT STUDY : AIMS AND HYPOTHESES.

The incidence of OOS has been a major occupational health problem for several years and information is needed on which to base preventive interventions. Most information used at present is based on Australian work as there is little published work in New Zealand which attempts to replicate or build upon the findings from Australia and other countries. In particular there has been no research in New Zealand to investigate the relationship of psychosocial factors to the incidence of OOS in keyboard operators.

Independent Newspapers Limited is a large New Zealand publishing chain, which owns eight newspapers in Auckland, Hamilton, New Plymouth, Palmerston North, Wellington, Timaru, and Invercargill. Within each newspaper there are several job categories into which VDUs have been introduced such as: reporting, sub editing, circulation, display setting, accounts and clerical. The size of the organisation with a variety of occupations across several similarly sized offices affords an opportunity to investigate aspects of OOS in the New Zealand situation.

Previous research into the psychosocial correlates of OOS in keyboard users, as detailed above, has shown that OOS rates vary across similar offices and that there is a relationship between stress in the social environment of work and OOS symptoms. The Work Environment Scale (Insel & Moos, 1974) measures factors in the workplace that indicate the presence or absence of stress and may be evaluated separately. The work of Karasek and colleagues (1981), suggests that some of these factors may have an interacting effect on stress related outcomes.

Accordingly the hypotheses of the present study are:

1. The rate of cervicobrachial pain reporting by keyboard workers will vary between newspaper offices.
2. The variations in pain reporting between offices are related to variations in the perceived quality of the work environment in each office.
3. There is an interaction between autonomy and job demand as measured by the WES, and their relationship to cervicobrachial pain reporting rates.

METHOD

3.1 PARTICIPANTS

Nine hundred and eighty one (981) VDU operators employed by Independent Newspapers Ltd. and working at eight locations throughout New Zealand, were surveyed. Appendix D shows the distribution of offices and job categories. There was a total of eighteen job types in the initial sample but these were collapsed to five job types and 'other' for the questionnaire. An examination of the job types reported under 'other' led to the addition of two more categories so that the eight job categories used in the final analysis were: reporter, subeditor, tele ads, display setting, accounts and clerical, typographers, systems, and other. Participants whose job was in the 'other' category were excluded from any analysis that involved type of work as a variable because they were not a homogeneous group.

Of the workers surveyed, 58.6% responded to the questionnaire, leaving 575 (see Table 2). Of these a further 25 were dropped because they did not complete the WES section of the questionnaire. The final number of participants' responses entered into the analysis was 550.

3.2 PROCEDURE

A questionnaire (Appendix A) was distributed to each keyboard operator in the appropriate offices in all the branches of INL (Appendix D). Each questionnaire was accompanied by the same covering letter (Appendix C) explaining the purposes of the study. It was made clear that participation was totally voluntary, but would be helpful for the purposes of the research. Two follow up letters (Appendix C) were also distributed to all participants to remind people to return the questionnaire, ten days and seventeen days after the initial distribution. Division managers were given explanations of the purposes of the study by letter

and personal communication, and an article explaining the general need for the project was published in the unions' newsletter.

Such a concentration on OOS as an issue could influence reporting rates (Andersson, Karlehagen & Jonsson, 1987) but not in any way that would be detrimental to the aims of this study which is comparative. It was considered more important that respondents to the questionnaire were as fully informed as possible and understood the purposes and importance of their part in the research.

Table 2.
The distribution and return rate of the questionnaires at INL offices.

Location	Questionnaires	Number Returned	Percentage
Wellington	292	149	51.02%
Invercargill	86	63	73.26%
Christchurch	210	129	61.43%
Hamilton	107	59	55.14%
Auckland	78	37	47.43%
New Plymouth	68	43	63.24%
Timaru	58	29	50.00%
Palmerston North	82	66	80.49%
Total	981	575	58.61%

3.3 THE MEASURES

Each questionnaire consisted of three parts, two of which were for the purposes of of investigating other factors contributing to OOS:

1. A section surveying the physical and ergonomic aspects of symptoms.
2. A behaviour pattern instrument (Jenkins Activity Survey)
3. A questionnaire specifically for the purposes of this study, including the WES, form S (Insel and Moos, 1974) and additional items (Appendix A).

1. Measuring Pain Reporting

To calculate the numbers of respondents in each office and job type who experience OOS symptoms, two questions from the first part of the survey were used. If respondents reported experiencing any discomfort at present they were asked to report the severity of the aches and pains for each part of the body (see Appendix B). Those people who scored 1 to 7 on the neck, shoulders, arms, wrists, or hands were included in the pain reporting category. (Inclusion of only high scorers was tested but made very little difference to the percentages, so it was decided to include all reported pain). These figures were used to calculate the percentage of neck, shoulder and arm pain reported in each office and job category.

2. Measuring the work environment

To measure the perceived characteristics of the working conditions the short form, form S, of the Work Environment Scale (Insel & Moos, 1974) was used, with one additional item used by Hopkins (1990) evaluating noise, as this variable was not assessed in the physical comfort subscale of the WES (see Appendix A). Respondents rated their environment on four items in each subscale (see Table 1 for a description of the subscales) which resulted in a score ranging from 0 to 4 on each of these 10 variables.

Hopkins (1990) took the workplace as the unit of analysis, calculating the score for each environment from the mean score of the individuals in that workplace. In a critique of the Social Climate Scales (of which the WES is one), Richards (1978) points out that interpreting statistics based on individuals as though they applied to aggregates, is an error that may be seen as the reverse of the "ecological fallacy": incorrect inferences made about individual behaviour from grouped data (Langbein & Lichtman, 1978). To avoid this error and to maintain

power of analysis, the unit of analysis for the present study was individual scores.

In this investigation, the WES was not used as a single measure of the environment, but interest was focused on the ten subscales considered as individual variables. The manual for the WES (Moos, Insel and Humphrey, 1974) reports only internal reliability figures for form R. Internal reliability statistics for form S calculated on the present sample are shown in Table 3.

Table 3.
Cronbach's Alpha Reliability Coefficients for the subscales of the WES.

Subscale Name	Cronbach's Alpha
Involvement	.4911
Peer Cohesion	.6161
Staff Support	.7221
Autonomy	.5971
Task Orientation	.5543
Work Pressure	.5032
Clarity	.6545
Control	.4198
Innovation	.5851
Physical Comfort	.4533
Pressure	.4752

In addition to the WES other standard quality of work items were included in the Hopkins study to cover job satisfaction, work pressure, variety in the job, boredom and perceived stress. During consultation with workers representatives in the design of the questionnaire, these items were favoured as "just the sort of questions " that these workers wanted to be asked about their job, giving further support for their inclusion on the grounds of high face validity. Following these discussions, an item on meeting deadlines was extended into three items to cover in more detail this important aspect of the newspaper publishing environment.

The job satisfaction item used by Hopkins was replaced by one which in New Zealand research, has been found to have a high (.79) correlation with the scores on a complete job satisfaction instrument (Hesketh & Shouksmith, 1986).

Nine items were finally used to cover the five aspects which were labelled 'personal difficulties' (see Appendix A) and the resulting five variables were scored as follows: Satisfaction, 1 to 5; Stress, 1 to 5; Bored, 1 to 4; Variety, 1 to 3; Pressure, 1 to 8 (the only multi item variable in this section).

Responses to all the items, from people in each office who were *not* in the pain reporting category, were used in the subsequent analyses.

3. Analysis of the Responses

All statistical analyses were performed using SPSSPC.

- i. Descriptive statistics were computed summarizing the information obtained. These included percentages and cross tabulations that were used to divide the sample into those who reported pain and those who did not, and work places with high and low percentages of pain reporting.
- ii. The first hypothesis was tested using Chi Square to establish whether the differences between the groups were significant.
- iii. To test the second hypothesis a Discriminant Analysis was performed with pain reporting levels between newspaper offices as the grouping variable.
- iv. To test the third hypothesis an interaction term was entered into the Discriminant equation.

- v. A post hoc analysis was performed because the initial descriptive statistics showed a significant difference between types of work on pain reporting percentages. The question asked was : Is the quality of working life (as measured by the 15 IVs) related to the differences between high and low pain reporting job types? A discriminant analysis was performed using the same 15 independent variables and the interaction term, with high and low pain reporting job types as the grouping variable.
- A third discriminant analysis was performed to test the interaction of the two dependant variables: high and low pain reporting between offices and between job types (four grouping variables).

RESULTS

Descriptive Characteristics of the Sample

The present sample included 550 participants of whom 208 are males and 340 females.

The age range was wide and reasonably evenly spread for a working population:

under 20 years	26 (5%)
20 to 30	204 (37%)
31 to 40	146 (27%)
over 40	173 (31%)

The number reporting pain was 161 (29.3%), which is an indication of the extensiveness of the problem among VDU users. Almost one third of this group of workers reported experiencing neck, shoulder and/or arm pain at the time of survey.

An examination of frequencies for all the other variables to be used in the analysis showed reasonable distributions except for the Physical comfort subscale of the WES. Here 424 (77%) responses scored 0 and the remainder only 1, showing that all the respondents were very dissatisfied with the physical environment of their workplace.

All missing data appeared to be randomly distributed (once those who had missed the entire WES were removed) so the group mean for each item on the WES was substituted, if that item was missing. Thus the rest of the information, from those questionnaires with only one or two missing items, remained in the analysis.

Crosstabulations were calculated to determine the percentages of pain reporting in each newspaper office and in each job type. The results were used to assign the individuals in each office to one of two groups: the high pain reporting group or the low group. The same exercise was performed with type of work because it was immediately apparent upon examination of the frequencies that there were differences between these groups. Table 4 shows the crosstabulations for newspaper office and pain reporting and Table 5 shows crosstabulations for job type and pain reporting. In Table 6 the composition and distributions of the two new variables, office pain and job type pain, are described.

Table 4.
Percentage of pain reports in each newspaper office.

Offices	N.	Pain %
Palmerston North	66	36.4
Hamilton	59	16.9
Timaru	28	32.1
Christchurch	129	36.4
New Plymouth	43	11.6
Invercargill	63	25.4
Auckland	37	27.0
Wellington	150	29.3

Table 5.
Percentage of Pain Reporting in each Type of Work.

Type of Work	N.	% Pain
Reporter	131	31.3
Sub editor	124	44.4
Tele Ads	60	16.7
Display Setting	61	16.4
Accounts/Clerical	132	21.2
Typographers	18	33.3
Systems	14	35.7
Other	33	27.3

Table 6.
Composition and distribution of between Job Type Pain Reporting and between Office Pain Reporting Groups.

	Offices	Job Types
Low Pain Group	Hamilton New Plymouth Invercargill N = 162	Tele Ads Accounts and Clerical Display Setting N = 237
High Pain Group	Palmerston North Timaru; Auckland Christchurch Wellington N = 388	Reporter; Sub Editor Typographer Systems N = 279

Inferential Statistics for Differences between the Groups.

To test the first hypothesis a Chi square test was performed on the differences between the newspaper offices on pain reporting. The results showed that the differences were significant:

Likelihood ratio chi square (7) = 18.66, $p = < .05$.

The differences between job types on pain reporting levels was also tested and the results were also significant:

Likelihood ratio chi square (7) = 20.79, $p = < .05$.

It would have been useful here to have tested the differences between job types across offices but numbers were not sufficient for an inferential test between these groups (54% of cells had expected frequencies less than 5). However a test was made of the differences between the groups of the 'office pain' variable (high and low) on pain reporting, controlling for 'job type pain'. When the job types low on pain reporting were tested the differences between offices were significant:

Likelihood ratio chi square (1) = 4.77, $p = < .05$.

For job types high on pain reporting the results were very similar:

Likelihood ratio chi square (1) = 4.53, $p = < .05$.

Predicting Group Membership, using Quality of Work Life Variables.

This part of the analysis was performed using only data from those participants who did not report pain, which left 389 cases in the analysis. A further 107 cases were randomly selected and held out for cross validation purposes. This left 282 cases which were used in each of the following discriminant analyses.

A stepwise discriminant analysis with Wilks' Lambda as criterion statistic was performed using fifteen variables as predictors of membership in two groups.

Predictors were: Involvement, Peer cohesion, Staff support, Autonomy, Task Orientation, Work pressure, Clarity, Control, Innovation, Physical comfort, Satisfaction, Stress, Pressure, Bored, Variety. Groups were High pain reporting newspaper offices and Low pain reporting newspaper offices.

To test for violation of the assumptions of normality of sampling distributions and homogeneity of variance-covariance matrices an F test was run on Box's M statistic for all the variables. There were no significant differences ($F(120, 137132.1) = 1.2120$, $p > .05$) indicating that there was no threat to multivariate analysis.

Univariate statistics revealed that only Clarity, Peer cohesion, and Staff Support showed any significant differences between the group means. However an examination of correlations (see Table 7) showed that there were many significant relationships between the variables, hence the need for a multivariate approach to avoid confounding. The correlations were all of a sensible direction and size except for Physical comfort which was negatively correlated with many other variables such as Satisfaction which is a counter intuitive result.

The stepwise discriminant analysis resulted in seven of the variables being entered into a discriminant function in the following order according to the size of contribution to the function: Peer cohesion, Staff support, Control, Work pressure, Autonomy, Physical comfort, and Stress. A test of Wilks' Lambda (.9180) showed that the variation between the groups was significant ($\chi^2(7) = 24.072$, $p = .0011$).

The function included all the between group variance but was not very strongly related to the groups themselves (Canonical correlation = .2863; eta square = .0819, which can be interpreted as explaining only 8% of the variance).

The model was tested by classifying the cases used in the analysis into criterion groups, and then cross validated on the hold out sample (see Tables 8a-b)

Table 7. *Correlations between the independent variables of the discriminant analysis.*

	Sat	Strss	Bored	Variety	Pressr	Involv	PeerCo	StaffS	TaskOr	Wrkprs	Clarity	Control	Innov	PhysCo	Aut\Wrkprs	
Sat	1.0000															
Stress	-.1954*	1.0000														
Bored	-.4176*	-.0850*	1.0000													
Variety	.4168*	.1434*	-.5312*	1.0000												
Pressure	-.1427*	.4992*	-.0152	.1258*	1.0000											
Involve	.3978*	-.0174	-.3890*	.3641*	-.0613	1.0000										
PeerCo	.3112*	-.1380*	-.1573*	.1931*	-.2154*	.4197*	1.0000									
StaffSup	.3646*	-.2025*	-.1923*	.1592*	-.2252*	.3498*	.3663*	1.000								
Auton	.2656*	-.0217	-.2558*	.3173*	-.0778	.3431*	.3164*	.4172*	1.0000							
TaskOr	.2595*	-.1588*	-.1454*	.1511*	-.2188*	.4475*	.2824*	.3391*	.2219*	1.0000						
WrkPrs	-.0035	.3761*	-.0676	.0952*	.3292*	.0751	-.0059	-.1003*	-.0900*	.1033*	1.0000					
Clarity	.3070*	-.2136*	-.1308*	.0964*	-.2850*	.3199*	.2487*	.4518*	.1209*	.5316*	-.0207	1.0000				
Control	.0439	.0211	.0500	-.1269*	-.0411	.0351	-.0213	.0336	-.2506*	.1368*	.1212*	.2649*	1.0000			
Innov	.2873*	-.0731	-.2070*	.2486*	-.1278*	.3371*	.3076*	.4489*	.3781*	.3266*	.0508	.2960*	-.0178	1.0000		
PhysCo	-.1669*	.0191	.1299*	-.1422*	.0785	-.1012*	-.1136*	-.1478*	-.1298*	-.1302*	.0918*	-.1784*	-.0892*	-.0720	1.0000	
Aut\Wrk	.1835*	.2411*	-.2193*	.2758*	.1478*	.3044*	.2099*	.2185*	.6249*	.2165*	.6160*	.0653	-.0756	.2941*	-.0138	1000

* p < .05

The Low and High pain reporting groups had a correct classification rate of 63.4% and 58.6% respectively, which is appreciably higher than chance. The cross validation unexpectedly improved on these results with the increase mostly for the Low group at 70%.

Table 8(a)

Classification Results of the first Discriminant Analysis (7 variables) using cases selected for use in the analysis.

Actual Group	No. of Cases	Predicted 1	Groups 2
Group 1 Low Pain	101	64 63.4%	37 36.6%
Group 2 High Pain	186	77 41.4%	109 58.6%

Percentage of cases correctly classified: 60.28%

Table 8(b)

Classification Results of the first Discriminant Analysis using cases not selected for use in the analysis.

Actual Group	No. of Cases	Predicted 1	Groups 2
Group 1 Low Pain	30	21 70.0%	9 30.0%
Group 2 High Pain	72	29 40.3%	43 59.7%

Percentage of Cases correctly classified: 62.75%

The classification results showed that this model is also better at predicting the low pain reporting group, but overall classification percentages were reduced (see Tables 9a-b).

Table 9(a)

Classification Results of the second Discriminant Analysis (8 variables) using cases selected for use in the analysis.

Actual Group	No. of Cases	Predicted 1	Groups 2
Group 1 Low Pain	101	65 64.4%	36 35.6%
Group 2 High Pain	186	79 42.5%	107 57.5%

Percentage of cases correctly classified: 59.93%

Table 9(b)

Classification Results of the second Discriminant Analysis using cases not selected for use in the analysis.

Actual Group	No. of Cases	Predicted 1	Groups 2
Group 1 Low Pain	30	19 63.3%	11 36.7%
Group 2 High Pain	72	31 43.1%	41 56.9%

Percentage of cases correctly classified: 58.82%

Testing the Variables

The aim of subsequent analyses was to minimise the number of variables, test each variable's importance in discriminating between the groups and maximise predictive power of classification.

It was found that reducing the number of variables could not improve the discriminant equation but adding variables to those chosen on statistical grounds had some effects.

The final group of variables was: Peer cohesion, Staff support, Control, Pressure, Clarity, Satisfaction, Work pressure, Autonomy, Stress and Physical comfort (Pressure, Satisfaction and Clarity added and the interaction term removed). Box's M once again tested as non-significant ($p = .2160$). Wilks' lambda remained significant at the .01 level (chi square (10) = 26.695 $p = .0029$) and explained 9% of the variance (canonical correlation = .2928). The partial correlations of the variables to the function are shown in Table 10, ordered by the size of the correlation.

Table 10.
*Correlations Between the Discriminating Variables
and the Canonical Discriminant Function.*

Peer Cohesion	.61876
Staff Support	.56072
Control	.45443
Pressure	-.39648
Clarity	.37807
Satisfaction	.34455
Work Pressure	-.30811
Autonomy	.20999
Stress	-.18109
Physical Comfort	.12436

The classification results show that classification is improved, in that the groups are equally well predicted and the overall percentage of correct classification is higher. The cross validation results show a slightly reduced percentage correct which is the expected result (see Table 11a-b).

Table 11(a)

Classification Results of the third Discriminant Analysis (10 variables) using cases selected for use in the analysis.

Actual Group	No. of Cases	Predicted Groups	
		1	2
Group 1 Low Pain	96	61 63.5%	35 36.5%
Group 2 High Pain	186	69 37.1%	117 62.9%

Percentage of cases correctly classified: 63.12%

Table 11(b)

Classification Results of the third Discriminant Analysis using cases not selected for use in the analysis.

Actual Group	No. of Cases	Predicted Groups	
		1	2
Group 1 Low Pain	35	23 65.7%	12 34.3%
Group 2 High Pain	72	30 41.7%	42 58.3%

Percentage of cases correctly classified: 60.75%

It should be noted that many of the differences between the variables were minimal, for example removing Pressure and adding Involvement, produced a very similar result to the one above. The important result was that five of the predictors: Peer cohesion, Staff support, Control, Work pressure and Physical comfort, were

consistently major contributors to the discriminant function. Peer cohesion was always the primary predictor whose contribution to the function remained virtually unchanged when other variables were partialled out. Only Bored, Variety and Task Orientation consistently made no contribution. Task Orientation was strongly correlated to Clarity and was partialled out of this analysis. Bored and Variety are opposite expressions of the same construct (and are strongly negatively correlated). They are also both highly correlated with Involvement.

Predicting Membership of the Job-Type Groups

A stepwise discriminant analysis using Wilks' lambda as criterion statistic was performed using the fifteen variables and the interaction term as predictors and High and Low pain reporting job types as the two grouping variables.

Several of the variables showed significant mean differences between the groups: Stress, Variety, Pressure, Involvement, Staff support, Autonomy, Work pressure, Clarity, Control, and Work pressure by Autonomy. Again because of high numbers of correlations between the variables, multivariate analysis was necessary.

The assumptions for multivariate analysis were met and an F test of Box's M was non-significant ($F(66, 243517.3) = 1.1570$ $p = .1799$) showing equality of covariance between the groups.

Eleven variables remained in the analysis. Table 12 lists the eleven variables in order of correlation within the function.

The function explained 34% of the variance (canonical correlation = .5805; eta square = .3365) and the difference between the groups was significant as the test of Wilks' lambda (.6630) shows: Chi square (11) = 112.801 $p = .0000$.

Table 12.
Correlations Between the Discriminating Variables
and the Canonical Discriminant Function (Third Analysis)

Pressure	.56178
Stress	.54365
Variety	.36768
Work Pressure	.35676
Clarity	-.34292
Autonomy	.33917
Control	-.32148
Involvement	.20232
Satisfaction	-.16623
Innovation	-.08854
Physical Comfort	-.01228

The classification results are reported in Table 13a-b. The Low group and the High group had 77.2% and 78.2% respectively correctly classified, and after cross validation this dropped to 65.85% overall.

Table 13(a)
Classification Results of the fourth Discriminant Analysis (11 variables) using cases selected for use in the analysis.

Actual Group	No. of Cases	Predicted Groups	
		1	2
Group 1		115	34
Low Pain	149	77.2%	22.8%
Group 2		29	104
High Pain	133	21.8%	78.2%

Percentage of cases correctly classified: 77.66%

Table 13(b)

Classification Results of the fourth Discriminant Analysis using cases not selected for use in the analysis.

Actual Group	No. of Cases	Predicted Groups	
		1	2
Group 1 Low Pain	43	28 65.1%	15 34.9%
Group 2 High Pain	39	13 33.3%	26 66.7%

Percentage of cases correctly classified: 65.85%

A third stepwise discriminant analysis with Wilks' lambda was performed to examine the interaction between the two sets of grouping variables. The fifteen variables listed above plus the interaction term were entered as predictors. There were four grouping variables: Group 1 was those cases in the Low pain newspaper offices and the Low pain job types; Group 2 was those in Low pain offices and High pain job types; Group 3 was those in High pain offices and Low pain job types; Group 4 was High pain offices and High pain job types. Box's M was non-significant ($p = .2120$) and all other assumptions were met.

Four of the variables were discarded by the stepwise analysis: Task orientation, Clarity, Innovation and Autonomy by Work pressure (although this interaction term was entered into the analysis at the fourth step it was removed after Work pressure entered at the twelfth step).

Two functions were significant. The first function accounted for 69% of between group variance and explained 29% of the variance (Wilks' lambda = .5976; Chi square (36) = 144.690 $p = .0000$). The second function accounted for 23.5% and explained 12% of the variance (Wilks' lambda = .8408; Chi square (22) = 48 $p = .0009$). These discriminant functions were not good predictors and classification results were no better than chance. The reason for this loss of predictive power is

found in the grouping of the individual variables' contributions to the functions. Table 14 shows the variables listed in order of their correlation to the functions.

Function 1 is related to those variables that best predicted differences between the work type groups (Stress, Pressure, etc). Function two features those variables whose strongest contribution was to the differences between office groups (Peer cohesion, Staff support, etc.). Clearly there are different factors contributing to the different levels of pain reporting between work type and between offices.

Table 14.
Correlations Between Discriminating Variables and the Canonical Discriminant Functions.

	Function 1	Function 2	Function 3
Stress	.54813#	.24340	-.05439
Pressure	.53044#	.07132	.47824
Variety	.41190#	.26555	-.22173
Work pressure	.35675#	-.03147	.40464
Autonomy	.33300#	.31804*	.05450
Control	-.29466#	.24843*	.62709
Peer Cohesion	-.12851	.62465*	-.06839
Staff Support	-.13341	.55126*	.03877
Boredom	-.14857	-.33342*	.19416
Satisfaction	-.16977	.21567*	.12111
Involvement	.18150	.20415	-.09260
Physical Comfort	.01334	.13591	-.10022

denotes those variables strongly related to function 1.

* denotes those variables strongly related to function 2.

Note that Control, Autonomy and Physical Comfort are similarly related to both functions. Between the remaining variables there are clear differences. The third function is not interpreted because it was not significant.

DISCUSSION

5.1 SUMMARY OF THE RESULTS

The results of this study support the three hypotheses, provide information about the variables involved and pose new questions through the post hoc analysis.

There were significant differences in the proportions of arm neck and shoulder pain reporting between the eight different newspaper offices of this sample. There were also significant differences between the eight different job type groups. There were not sufficient numbers to test for differences in pain reporting between offices across each job type, although there were significant differences between the high and low pain reporting offices for each of the high and low pain reporting work-type groups.

The differences between the High and Low pain reporting office groups were significantly related to perceptions of the quality of the work environment. The factors that are more likely to be perceived in an environment in which there is also less pain reporting are: higher Peer cohesion, higher Staff support, higher Control, less Pressure, more Clarity, greater Satisfaction, less Work pressure, less Stress, greater Autonomy, and more Physical comfort. These psychosocial factors account only for a small proportion of the variance, but because they are only being considered as a part of the aetiology of OOS symptoms, their small contribution to pain reporting is sensible. The moderate predictive power of the discriminant equation is also considered a good result considering that the differences between the groups is only proportional, i.e. both groups had relatively high numbers of people reporting pain and the 'high pain' group of offices were chosen on the grounds of having a (in one case only moderately) higher proportion of pain sufferers.

There was a modest interaction between Autonomy and Work pressure and this proved to be a significant contributor to the differences between the office groups.

However, the interaction term did not add to the predictive power of the equation and there was no interaction effect between the job type groups.

The variables showed a stronger effect when the differences between type of work on pain reporting were tested. The factors most likely to be perceived in a job type that has lower reports of neck, shoulder and arm pain are: less Pressure, less Stress, less Work pressure, less Variety, more Clarity, less Autonomy, more Control, less Involvement, greater Satisfaction, more Innovation, and greater Physical comfort. Some of these effects (Variety, Autonomy and Control) are not in the expected direction. Autonomy is in the opposite direction to the effects for the differences between offices.

The most likely explanation is that the strongest contributors to the equation (Stress, Pressure and Work pressure) are responsible for the differences. It seems likely that jobs such as reporting and sub editing, which have more variety and autonomy than clerical type work, also carry a heavy stress component that is affecting workers' health.

These variables are important factors in the effect that type of work has on pain reporting and there is a stronger effect than for the differences between offices. However there is another important difference: different sets of the variables are influencing the different groups and this was confirmed by the third stepwise analysis which showed that there are two distinct sets. The first set could be described as a 'personal interaction' set whose most important contributors are Peer cohesion and Staff support and the second as a 'workstyle' set dominated by Stress and Pressure. The personal variables are the important factors in discriminating between offices, and the workstyle variables are the dominant feature of the differences between job types.

It is possible that some job types in the newspaper industry (that has a high incidence of OOS: Bartholomew, 1992) have their own peculiar combination of work variables contributing to the incidence of OOS symptoms in the workplace.

Reporters, and sub-editors in particular are likely to have more autonomous but high pressure jobs with unusual shift times and high work loads, including intense use of the keyboard that would contribute to OOS symptoms. This pattern is different to the usual areas of investigation that have focused on monotonous, low autonomy but high work pressure type jobs. The results of these studies (e.g. Hopkins, 1990; Linton & Kamwendo, 1989; Smith et al., 1981) are supported here by the set of psychosocial variables that predicted differences in pain reporting between offices. The results of the present study also show that there is a different set of factors that are important to some job types. Further investigation into these factors will need to begin with job analysis for the purposes of effectively comparing job types.

5.2 METHODOLOGICAL LIMITATIONS

1. The Variables and their Measurement

Most of the variables used had a contribution to make and only "Bored" is considered superfluous and could be omitted from future investigations. The consideration of additional variables should be made from a theoretical basis.

"Physical comfort" had an extremely abnormal distribution but enough variance to contribute to the analysis. As the differences between the groups were in the expected direction, it was concluded that the whole sample considered their workplaces uncomfortable and the unexpected negative correlations were not interpreted.

"Stress" and "Pressure" were strongly correlated and it was considered that one or the other could be superfluous. However test runs showed that both were making separate contributions to the predictive power of the second analysis. However because the Stress variable is only one item based on the word 'stress' this item is

considered to have very little construct validity considering that it is unknown, except in a very general way, what each respondent's understanding of 'stress' is. Therefore it would be important to examine the psychometric properties and the very meaning of this item before it was used in further investigations. It should probably be replaced with other more specific items. The WES itself was considered to be measuring the presence or absence of stress through variations in the quality of work. However the importance in the analysis of the extra standard quality of work items used show that there are dimensions of stress not tapped by the WES alone.

The internal reliability for each subscale of the WES and for "Pressure" was not good overall with only "Staff support" showing reasonable reliability. This aspect of the measures must be addressed if they are to be used again, as poor reliability does not support the validity of the present results.

2. Aetiological Implications.

Although Hopkins (1990) concludes that the evidence from his study can be interpreted as support for the hypothesis that poor job quality contributes to RSI, more significant results from the present study do not allow us to draw the same conclusions about causal direction. Cross-sectional designs, using naturally occurring groups without proper experimental controls, cannot justify inferences of causality (Tabachnick and Fidell, 1989). The results from the present study confirm associations between psychosocial factors and OOS reporting, but can only be said to not refute any hypotheses about aetiology.

3. Problems with the Perception of Psychological Factors

This is a serious problem concerning public interpretation of the results of this and similar studies, and public reaction to participating in these studies. Owing to the medical, legal and social controversies outlined in the first chapter, suggestions of

psychological factors involved in the aetiology of OOS have been used as indications of malingering or that the pain is in people's heads and therefore not real. This has resulted in prejudice in the work place against OOS sufferers and worse medical and legal problems to be faced in the search for treatment and compensation (Bammer & Blignault, 1988; Nicolson, 1992). Reid, Ewan and Lowy, (1991) have analysed several women's case histories to show that they have in common a search for the credibility that was denied : "The only representations of the complex interaction between psyche and soma which the women encountered were dismissive, denigrating inferences that they were neurotic or a 'psyche case'" (p.610). Reid and colleagues found that many women accepted that their symptoms were partly caused or aggravated by stress but could not afford to admit that their personalities or life situations might have been contributing factors in other ways, in case this was construed by others as evidence for psychogenic causes which were seized on by insurance companies, doctors and employers as a cause for dismissal of the complaint.

Similar fears were voiced to us during the course of this study. After the questionnaires had been distributed, we received a letter from a former INL employee and current OOS support group member who was concerned about the implications of research into psychological causes and its affect on people currently suffering symptoms in the work place, whose stress and misery could be increased. This person's own horror story is similar to those many told to Reid and colleagues, in which implications of psychological causes invalidated the reality of the painful physiological effects and served to increase distress and suffering. Furthermore, the correspondent reported that many people in fear and anger had refused to fill in the questionnaire, or omitted the second and third sections, which explains the missing sections (20 for section three) and the low response rate overall.

Clearly it is of the utmost importance that the dualistic notion of psychogenic causes is laid to rest and that health professionals accept the reality of pain whatever its hypothesised causes. There is certainly much work currently being done in this area. For example: The Occupational Safety and Health section of the Department of

Labour has recently published a handbook for practitioners (Wigley et al., 1992) outlining the known factors involved and stressing that most cases are genuine sufferers; Drs Wigley and Welch regularly publish information in the New Zealand Medical Journal, Dr Welch in particular outlines the details of compensation cases; many large organisations such as INL now have improved occupational health support, so that management and staff are also educated in helpful attitudes.

However, there is still clearly fear and misunderstanding which researchers must be sensitive to, ensuring that their work does not in any way harm participants. It was considered that by consulting with worker's representatives and explaining the purposes of the study, these difficulties would not be met, but it is clear that even more care is necessary in this sensitive area. Concern must also be given to the presentation of the results of such studies.

5.3 FUTURE DIRECTIONS

Before any further research in this area is discussed it is necessary to consider more closely the theoretical framework that should give structure and direction to empirical findings. The work in this line of research (psychosocial factors and OOS) including the present study, has been largely conducted in a heuristic mode, in which positive findings have led to further work and replication of the known facts, with some anomalies but strong indications that there is a relationship (see chapter 2). These results are open to interpretation according to the stance of the investigator and practical recommendations may be made, using the results of such research, according to the social, organisational, economic or political position of the user. While the pathology of OOS is still unclear and the links between psychosocial factors and illness are unknown, a strong theoretical base that accounts for all the existing evidence, can explain anomalous findings and includes a biopsychosocial approach, is essential to guide further research. Without such a base OOS as an illness has tended to fall into the gaps created by the inadequacies of the biomedical model, to the detriment of sufferers.

The Biopsychosocial Approach

The biomedical model assumes a direct cause and effect relationship between an illness and its symptoms. It does not attend to the psychosocial aspects of the illness process and provides a poor fit to many contemporary health problems. A biopsychosocial model views symptoms as stimuli that are subject to complex psychosocial processes and therefore susceptible to influences beyond those explained by physiological mechanisms alone (Cioffi, 1991; Shuval, 1981).

Theories of Pain

In the area of pain research itself the Cartesian dualistic concept of pain as dependent on specific sensory pathways has been largely abandoned, especially since the publication of the Gate Control theory by Melzack and Wall (1965). However the concept of psychogenic pain has come from a perspective that continues to draw on a mind/body dualism approach that pain is a body phenomenon and if examination fails to reveal evidence of injury then the problem must be in the mind i.e. it is psychogenic. The naive clinician may then consider that the pain is not real, although the notion that one can have pain without the body being involved should have long been discarded (Fordyce, 1986).

The Gate Control theory holds that pain pathways are controlled in the dorsal horns of the spinal cord, where the sensory messages are interpreted, depending upon input from other senses and from the brain itself. This plasticity of the pain transmission system gives a variable relationship between stimulus and response adapting to the organisms circumstances. This theory accounts for variations in pain response and for pain that continues after the injury is repaired or in the absence of injury. There has been much research since publication of the theory resulting in evidence to support the Central Nervous System (CNS) input into pain

modulation and variations. Some of this work has been summarised in a review by Fields (1988) who believes that the findings raise the possibility that pain can be generated by the CNS through physiological mechanisms. Wall (1988) offers further explanations, believing that it is certain that central transmission pathways as well as peripheral pathology must be considered in all painful conditions.

Current Theories of Causality

Until recently, there has been little attempt to relate these sorts of findings to OOS research in terms of specific links between psychosocial factors and the manifestation of acute and chronic pain. Most reports have simply acknowledged that the pathology is unknown or made general suggestions, such as muscle tension leading to injury, impaired blood flow, neuromuscular fatigue, or a decreased immune response (Bammer, 1987; Green & Briggs, 1990; McDermott, 1986; Ryan & Bampton, 1988). Wigley and colleagues (1992) have published in New Zealand, an explanation based on hypotheses and models from Large and colleagues (1990) and Edwards (1988). They hold that muscle tension restricts blood flow which leads to a build up of lactic acid, stimulating pain receptors. This muscle pain causes neighbouring muscles to tense up which is a normal reaction to injury, but in the case of OOS can lead to a self sustaining pain cycle. The risk from tension is increased when high rates of repetition and/or force occur. The primary cause is considered to be tension which may be caused by: poor posture, repetition of force, jerky movements, social stressors, and being driven hard or driving oneself.

Wright (1987) proposed a similar cycle as part of a complex model of how psychosocial factors might cause pain through psychological and physiological reactions to stress. Powell (1991) tested the aspects of Wright's model that propose that job stress is associated with anxiety at work, muscle tension and musculoskeletal trouble. The findings gave some empirical support to the model, showing that job stress, anxiety, muscle tension and pain are related, although not

necessarily in the way the model indicates. For example, although there was some relationship between muscle tension and musculoskeletal troubles, there was also a direct association between strain (one of two stress measures) and musculoskeletal trouble and between anxiety and musculoskeletal trouble, indicating that muscle tension is not always implicated. No other empirical tests of this model have been found.

From those theories in which all the known variables contribute to OOS through muscle tension, a general model may be drawn which shows links and pathways as described in Figure 2.

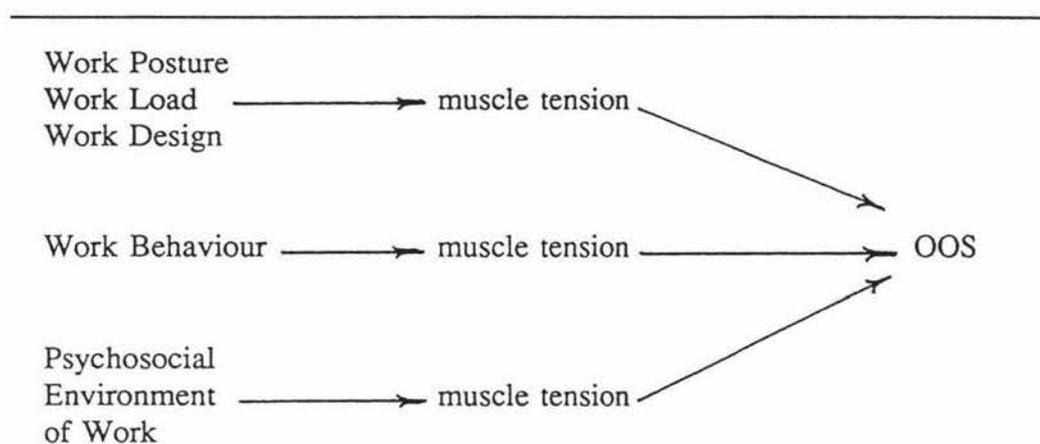


Figure 2. A model describing suggested causal links between multiple factors and OOS.

Theories of stress and illness, such as those of Cassel (1974) and Totman (1979) suggest a move away from the notion of specific causes for specific illnesses to a recognition that psychosocial processes are unlikely to be directly pathogenic. Cassel has suggested that a theoretical framework that views psychosocial factors as increasing susceptibility to illness would be more fruitful. Totman has published a description of such a theory based on the structure of social situations and the importance of the maintenance and consistency of social rules in relation to susceptibility to illness.

Mullaly and Grigg (1988) propose that all categories of OOS may arise from physical demands (created by poor work conditions, posture etc.) but the causes of the diffuse type of OOS in particular are moderated by psychological factors. In 1992, Cohen and colleagues published a new hypothesis suggesting that OOS (called refractory cervicobrachial pain syndrome) may be of neuropathic pathogenesis: the pain of OOS is due to a malfunctioning of the central pain signalling pathways. The schema, by focusing on central mediation via the dorsal horn, accounts for the development of chronic pain and allows for influences, by descending pathways, of factors in the personality, culture and environment of the individual. Early testing has not led to the refutation of the hypothesis which provides the necessary causal links in Mullaly and Grigg's model.

The general model for those theories that see psychosocial factors as mediators between physical causes and OOS may be described as in Figure 3.

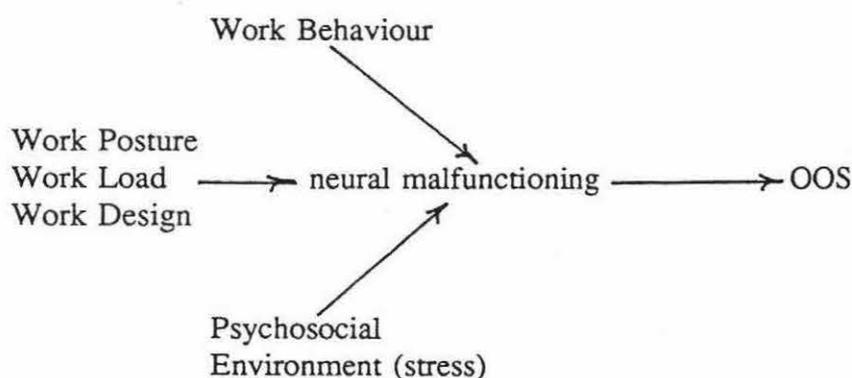


Figure 3. An alternative model of links between multiple factors and OOS.

This theoretical approach fits the known empirical findings (Mullaly & Grigg, 1988, Quinlan & Bohle, 1991), is consistent with current knowledge of the causes of chronic pain and explains anomalies of recent empirical research, i.e. stressful factors in the workplace that may be implicated in illness outcomes are situation

dependent. Thus OOS sufferers who have been involved in VDU tasks with low autonomy but high work pressure, such as data entry processors, were possibly subjected to different stressors than sufferers in an autonomous, but highly pressured VDU task, such as Reporting, although the outcome in both cases is the same.

The second model also takes a more cogent view of the multifactorial approach to OOS, in that the factors are seen to contribute according to theoretical links rather than as a list of risk factors which alter according to the situation but are locked in a model that does not allow the generation of further explanatory hypotheses. Spicer and Hong (1992) have demonstrated that a theory based approach to multiple factors in heart disease research is more likely to advance understanding than a risk profile strategy. Accordingly, recommendations for future research are made on the basis of the second model.

Future Research

There are two broad aspects to these proposals: the narrow focus on refining the measurement and construct definition of the psychosocial variables and the dependant variable and secondly, broadening the field by including the other physical and personal variables in a more complete multifactorial approach.

In the first instance there is a need for exploration of the differences between job types (by job analysis and comparison) so that possible stressors may be isolated and tested. This work would be related to finding valid constructs and reliable operational definitions that could be used to measure the ill-defined area of stress and pressure. There could be more work done on developing more reliable measures for those variables that are well defined but poorly measured and show a relationship to OOS symptoms. These variables could also be studied in terms of their theoretical position as stressors. It would also be useful to know how

reports of OOS symptoms (as used in the present study) relate to diagnosed cases of OOS and to the development of chronic pain.

Secondly the scope of the research must expand to include all the known factors, so that the hypotheses initially generated by the model may be tested. This would be to answer initial questions such as: Do psychosocial factors moderate the links between the physiological factors and OOS? Such work, if it included prospective studies could also address the issue of chronicity in detail by studying the effects of changes in stressful environments.

Implications for Prevention

The present findings reinforce the suggestions that psychosocial variables must be considered in prevention programmes. It is also apparent that both the nature of the work and the quality of the work environment are potentially stressful, so that both aspects should be examined when considering work design because the nature of the stressors is different in each case. For example, when considering the case of reporters or subeditors, in which work pressure is strongly implicated, then changes could be made in terms of work demands, schedules, and shift work. When considering each workplace as a whole it is apparent that there is a need for redefinition of the social relations that structure the work environment as an important aspect of prevention. Job redesign could include more sociable organisation (e.g. smaller autonomous groups), improved support from supervisors and management, and clear direction with less pressure.

5.4 SUMMARY OF CONCLUSIONS

The results of this study support previous work in this area and in particular improve upon the results of Hopkin's 1990 study showing that the associations are significant. It is apparent that in this New Zealand sample, as has been found in Australia and other parts of the world, there are important relationships between psychosocial factors and the incidence of OOS. These findings separate the stressful psychological factors associated with higher pain reporting from those that may have resulted from the experience of pain.

The psychosocial aspects that should be taken into account when designing work situations with less stress are primarily personal relationships with co-workers and supervisors, and personal involvement with the work itself. However, these factors are probably overshadowed when the nature of the work and its inherent pressures are stressful. In these situations work pressures should be taken into account when designing work levels and schedules.

The results of empirical investigations and research, even if prospective designs are included, are limited to the specific context in terms of practical recommendations and predictions. These designs cannot determine general causes nor explain differences in the effects of individual psychosocial variables between different workplaces. There is a need for more work at the theoretical level, so that advances can be made in investigating the nature of OOS and the aetiological factors involved.

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APPENDICES.

APPENDIX A: The Questionnaire Used in the Present Study.

SECTION THREE

WORK ENVIRONMENT

These are statements about the work environment.

Please indicate how well each statement describes your place of work. Circle the number of the answer that you think is appropriate. For example, for Q1,

1. The work is really challenging.

If the appropriate answer is "Yes", then circle "1".

Use your opinion or perception in answering these questions.

1. The work is really challenging.

1. Yes.
2. No.

1 []

2. People go out of their way to help a new employee feel comfortable.

1. Yes.
2. No.

[]

3. Bosses tend to talk down to their employees.

1. Yes.
2. No.

[]

4. Few employees have any important responsibilities.

1. Yes.
2. No.

[]

5. People pay a lot of attention to getting work done.

1. Yes.
2. No.

[]

6. There is constant pressure to keep working.

1. Yes.
2. No.

[]

7. Things are sometimes pretty disorganised.
1. Yes. []
2. No. []
8. There's a strict emphasis on following policies and regulations.
1. Yes. 8 []
2. No. []
9. Doing things in different ways is valued.
1. Yes. []
2. No. []
10. It often gets too hot.
1. Yes. []
2. No. []
11. There's not much group spirit.
1. Yes. []
2. No. []
12. The atmosphere is somewhat impersonal.
1. Yes. []
2. No. []
13. Bosses usually compliment an employee who does something well.
1. Yes. []
2. No. []
14. Employees have a great deal of freedom to do as they like.
1. Yes. []
2. No. []
15. There's a lot of time wasted because of inefficiencies.
1. Yes. []
2. No. []
16. There always seems to be an urgency about everything.
1. Yes. []
2. No. []

17. Activities are well planned.
1. Yes.
2. No. []
18. People can wear wild looking clothes on the job if they want to.
1. Yes.
2. No. ¹⁸ []
19. New and different ideas are always being tried out.
1. Yes.
2. No. []
20. The colours and decor make the place warm and cheerful to work in.
1. Yes.
2. No. []
21. A lot of people seem to be just putting in time.
1. Yes.
2. No. []
22. People take a personal interest in each other.
1. Yes.
2. No. []
23. Bosses tend to discourage criticisms from employees.
1. Yes.
2. No. []
24. Employees are encouraged to make their own decisions.
1. Yes.
2. No. []
25. Things rarely get "put off till tomorrow".
1. Yes.
2. No. []
26. People cannot afford to relax.
1. Yes.
2. No. []

27. Rules and regulations are somewhat vague and ambiguous.
1. Yes.
 2. No. []
28. People are expected to follow set rules in doing their work.
1. Yes.
 2. No. ²⁸ []
29. This place would be one of the first to try out a new idea.
1. Yes.
 2. No. []
30. Work space is awfully crowded.
1. Yes.
 2. No. []
31. People seem to take pride in the organisation.
1. Yes.
 2. No. []
32. Employees rarely do things together after work.
1. Yes.
 2. No. []
33. Bosses usually give full credit to ideas contributed by employees.
1. Yes.
 2. No. []
34. People can use their own initiative to do things.
1. Yes.
 2. No. []
35. This is a highly efficient work-oriented place.
1. Yes.
 2. No. []
36. Nobody works too hard.
1. Yes.
 2. No. []

37. The responsibilities of bosses are clearly defined.
1. Yes.
 2. No. []
38. Bosses keep rather close watch on employees.
1. Yes.
 2. No. ³⁸ []
39. Variety and change are not regarded as particularly important by management.
1. Yes.
 2. No. []
40. The lighting is quite satisfactory.
1. Yes.
 2. No. []
41. It often gets noisy.
1. Yes.
 2. No. []

PERSONAL DIFFICULTIES

1. Do you feel that considering all its aspects, your job is a very good one?
1. All of the time.
 2. Most of the time.
 3. Some of the time.
 4. Hardly ever. []
 5. Never.
2. How often do you feel that you have to push yourself in your work - that you are not working fast enough?
1. Most of the time.
 2. Some of the time.
 3. Rarely or never. []
3. Do you regularly have to meet deadlines?
1. No.
 2. Yes, daily deadlines.
 3. Yes, weekly deadlines.
 4. Yes, monthly deadlines. []

4. Do you feel that you normally have adequate time to meet deadlines?
1. Most of the time.
 2. Some of the time.
 3. Rarely, or never. []
5. Do you regularly miss your deadline?
1. Most of the time.
 2. Some of the time.
 3. Rarely, or never. ⁴⁶ []
6. Do you regularly have to miss breaks? (rest breaks and/or meal breaks).
1. Yes.
 2. No. []
7. Taking all things together, how stressful would you say your job has been over the past year? (or during the time you have been here if less than a year).
1. Not at all stressful.
 2. A little stressful.
 3. Moderately stressful.
 4. Very stressful.
 5. Extremely stressful. []
8. If you consider your work over a number of weeks, would you say you felt bored:
1. Most of the time.
 2. Some of the time.
 3. Rarely or never. []
9. How much variety is there in your work?
1. Very little.
 2. Some.
 3. A good deal. []

THANK YOU FOR YOUR TIME.

APPENDIX B: The question from the first section of the questionnaire; responses to which were used to assess the prevalence of pain reporting in INL offices.

20. Please state the severity of the aches and pains for each part of the body you find discomfort in. Use the seven point scale given below.

For example, if you have only slight pain in the shoulders place a 1 in the box provided beside shoulders. (Use whole numbers only please.)

1 2 3 4 5 6 7

Slight aches and pains	Mild aches and pain	Severe aches and pain
Neck	[]	[]
Shoulders	[]	[]
Right arm	[]	[]
Left arm	[]	[]
Right wrist	[]	[]
Left wrist	[]	[]
Right hand	[]	[]

APPENDIX C: Letters accompanying the questionnaires.



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FACULTY OF
SOCIAL SCIENCES

DEPARTMENT OF
PSYCHOLOGY



12 May 1992

Dear INL worker,

THE INL OCCUPATIONAL OVERUSE SYNDROME (OOS) STUDY

The enclosed questionnaire has been designed to investigate OOS in INL. OOS (also known as Repetitive Strain Injury) is the phenomenon which describes the muscular aches and pains that are associated with keyboard use. Due to the occurrence of OOS in INL staff a research team has been formed with the aim of reducing this problem.

The questionnaire has been developed with the guidance and support of INL unions represented by Corrine Ambler and Penny Harding, Jenny Beek (Occupational Health Nurse), Frank Darby (Occupational Safety and Health, Department of Health), and five Massey University researchers (Mike Smith, Bert Biggs, Jon Dannatt, Christine Stephens, and Ross Pirie).

The questionnaire has three sections. Section one is a self reporting form for pain and discomfort, section two investigates the relationship between work related behaviours and OOS, and section three investigates the links between the work environment and OOS.

Participation in this study is voluntary, but it will help to discover possible therapies and build a picture which will, we hope, significantly reduce OOS occurring in the workplace. Complete anonymity is assured since no individual form can be identified and only group data will be reported. Thank you, in anticipation, for your assistance and time.

Yours sincerely,

Mike Smith
Bert Biggs
Jon Dannatt
Ross Pirie
Christine Stephens
Frank Darby
Jenny Beek

1.

Dear INL worker,

You will recall receiving a questionnaire to complete, in support of the INL Occupational Overuse Syndrome project. It is essential to the success of the project that as many of the questionnaires as possible are completed and returned.

If you have not yet completed and returned your questionnaire, we would appreciate your doing so as soon as possible.

If you do not wish to complete a questionnaire please return the forms to the designated person in your office.

Your response will remain confidential and untraceable to any individual. Thank you for your help.

Yours faithfully,

Mike Smith
Jon Dannatt
Ross Pirie
Christine Stephens

2.

Dear INL Worker,

To complete the INL Occupational Overuse Syndrome survey, it is important that as many questionnaires as possible are completed and returned. If you have not completed or returned your questionnaire, could you please do so as soon as possible?

If you have lost your form but are willing to complete the questionnaire, please ask the designated person in your office for another copy.

If you have any problems with procedures for completing the questionnaire, do not hesitate to ask for advice or for another copy if necessary.

If you do not wish to take part in the survey, please return your uncompleted form.

Thank you for your time and trouble. We hope that the results of this project will be of benefit to all VDT workers.

Yours faithfully,

Mike Smith
Jon Dannatt
Ross Pirie
Christine Stephens

APPENDIX D: Distribution of workers in job types across the INL offices.

Occupational Overuse Questionnaire Research
 Workers in sample by Location as at April 1992
 All are full time. Format used is same as INL reporting formats

Use this as a guide to send out the questionnaires in your location
 The numbers may of course not be exact now. So they should be used as a guide only

Location	Reporters	Sports	Racing	Features	Illustrations	Executives	Sub-Editors	NIE	Clerical	Library	Other	Paste up Day	Paste Up Night	Keyboard Oper Day	Keyboard Oper Night	Gen Hands & Apprent	Tele Ads	Accounts	Total	
Wellington	67	10	4	5	19	21	58	4	9	5	1	14	9	11	5	4	19	29	292	
Invercargill	24	1	2	0	4	2	14	1	1	0	0	3	1	6	1	1	7	18	86	
Christchurch	48	9	3	4	14	3	39	3	2	4	0	1	3	17	18	5	10	27	210	
Hamilton	18	3		0	4	7	18	3	0	1	1	7	2	3	3	0	15	22	107	
Auckland	15	5	11	0	4	8	9	1	3	3	1	3	0	0	0	2	0	13	78	
New Plymouth	17	2	1	2	5	2	13	1	1	0	0	0	0	6	6	1	6	5	68	
Timaru	11	1	1	2	3	3	12	1	0	0	0	1	1	3	4	1	2	12	58	
Palmerston Nth	30	2	2	0	1	3	9	0	0	0	0	13	0	8	0	0	0	14	82	
Totals	230	33	24	13	54	49	170	14	16	13	3	42	16	54	37	14	59	140		
Total Sample	981																			
												Notes								
												Hamilton Accounts Include "Accounts -Waikato Times "and "Accounts - ICN"								
Dated June 2nd 1992																				