



Work, inequality and musculoskeletal health

Prepared by the
University of Surrey
for the Health and Safety Executive

CONTRACT RESEARCH REPORT
421/2002

© Crown copyright 2002

*Applications for reproduction should be made in writing to:
Copyright Unit, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ*

First published 2002

ISBN 0 7176 2312 2

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

Work, inequality and musculoskeletal health

**Valerie Woods and Professor Peter Buckle
Robens Centre for Health Ergonomics
European Institute of Health and Medical Sciences
University of Surrey
Guildford
Surrey GU2 7TE**

A review of the relationship between aspects of work, inequality and musculoskeletal health was undertaken. As there are no existing models regarding musculoskeletal disorders and inequality, the socio-economic model of health and inequalities (Dahlgren and Whitehead, 1991) was used to structure this review.

The following workplace factors and their associations with musculoskeletal ill health were reviewed:

Social support: Studies investigating the association between social support and musculoskeletal symptoms indicate that poor social support is a risk factor for developing or reporting problems. It is also considered to be an important factor in coping with musculoskeletal disorders.

Access to health information/education at work: Access to information that promotes healthy working practises either at work or in the community may have a role in the prevention/reduction of musculoskeletal ill health problems. The majority of studies have considered the effectiveness and design of training and/or information programmes. Modern approaches to ergonomic interventions have shown the importance and value of a participatory approach that involves facilitation, access to information and appropriate participation. The evidence suggests that the role of health information and education within such an intervention strategy is important.

Job insecurity, temporary contract work and piecework: Along with greater labour market flexibility and deregulation of employment contracts has come greater job insecurity. While all sections of the workforce have been affected by these trends, less skilled manual workers at the lower end of the labour market have been affected the most, in terms of greater exposure to low paid, temporary and insecure employment (Acheson, 1998). Studies looking at these job conditions show an association with musculoskeletal ill health. The association between gender and these job conditions may also be important as the majority of the studies have been conducted on female low status workers.

Low status work: For this review, 'low status' work has been taken to mean unskilled, paced, or repetitive work; jobs where no training is required; where there is a low requirement to make decisions; low pay; or low control over the job. All studies reviewed indicated that the risk for the development of musculoskeletal disorders increases in jobs of lower status.

Income: Studies investigating income, often linked to occupational class and low status jobs, and musculoskeletal health show that lower income levels appear to be associated with a greater occurrence of musculoskeletal disorders.

Some individual factors and their associations with musculoskeletal ill health were also reviewed:

Education level: The limited literature on education level and musculoskeletal disorders has generally shown that a lower level of education is associated with a greater risk of the development of problems. The studies have generally not controlled for other well-established risk factors, such as physical workload.

Age: Whilst older age appears to be a risk factor for musculoskeletal ill health, it is often highly correlated with years spent in work and a number of indicators of musculoskeletal disorders and disability. A greater emphasis on specific relationships may help focus preventive programmes.

Gender: Investigations of the association of gender with musculoskeletal symptoms have often found that women are more likely to develop or report a problem than men. Some studies have acknowledged differences in job conditions, experience at work and home, and willingness to report as possible reasons for these differences. More research is required on whether musculoskeletal risk varies between men and women in jobs with the same occupational exposure.

Ethnicity: Musculoskeletal health differences have been found between people from different ethnic backgrounds. In some studies, minority and immigrant workers had a higher prevalence of musculoskeletal ill health; in others, majority groups had more musculoskeletal problems. In making these comparisons the studies have generally failed to control for other risk factors.

Gaps in knowledge are evident and basic terms and definitions missing. This, along with the complex interrelationship and lack of independence of the variables, has meant that attributing causal relationships is not possible. In view of the strength of many of the associations with both general health and musculoskeletal health, areas of future research have been advanced and prioritised.

The predominant focus has been on physical and psychological factors relating to the worker at the workplace. Whilst some studies have broadened the scope to also consider psychosocial factors (e.g. temporary or insecure work, social support at work) there remains a paucity of knowledge for socio-economic factors such as poor housing, access to health care services and unemployment.

This report and the work it describes were funded by the HSE. Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

LIST OF CONTENTS

ABSTRACT	2
INTRODUCTION	
Aim of the study.	6
Background.	6
Musculoskeletal disorders.	7
Socio-economic model of health and inequality.	8
Proposed map of potential variables.	9
Report format.	11
LITERATURE REVIEW	
Section 1 – Workplace factors	
Introduction.	12
Social support and musculoskeletal ill health.	13
Access to health information and musculoskeletal ill health..	21
Job insecurity, temporary, piece work and musculoskeletal ill health.	26
Low status work and musculoskeletal ill health.	29
Income and musculoskeletal ill health.	35
Section 2 – Individual factors	
Introduction.	38
Education level and musculoskeletal ill health.	39
Age and musculoskeletal ill health.	42
Gender and musculoskeletal ill health.	48
Ethnicity and musculoskeletal ill health.	57
DISCUSSION	64
CONCLUSIONS	70
REFERENCES	71

INTRODUCTION

AIM OF THE STUDY

The aim of this study was to review the contemporary literature on the relationship between inequality, work and musculoskeletal health.

BACKGROUND

The recently published *Independent Inquiry into Inequalities in Health Report* (Acheson, 1998) made reference to the association between lack of control, poor skill use, low job variety and the increased risk of musculoskeletal disorders and sickness absence. The report recommends that employers take further measures to improve health at work through good management and organisational practises.

Acheson (1998) recommends that all policies having a direct effect on health should be evaluated in terms of their impact on health inequalities and should favour the less well off to try to reduce these inequalities. This review will focus on how such inequalities might impact on the musculoskeletal health of the workforce.

There are, to our knowledge, no established models regarding inequality and musculoskeletal disorders. The review will consider the potential contributory influences of a range of workplace variables including: low status jobs, poor job security, low pay, piece work payment, poor social support and lack of access to health information. It will also consider a number of individual factors (e.g. age) that may mean workers are more likely to be exposed to these workplace variables. These factors may group together as risk factors for the development of musculoskeletal problems.

The review will not consider physical workplace risk factors directly. These have been adequately covered in a number of recent reviews including NIOSH (1997), Buckle and Devereux (1999) and NAS (2001).

A review involving the psychological, socio-economic, occupational health, medical and ergonomic literature was conducted. The literature review included information on musculoskeletal disorders obtained from the following sources:

- Scientific peer reviewed journals
- Conference proceedings
- Abstracts
- Recent textbooks
- Internally reviewed government/regulatory body reports

- CD ROM and online commercial and regulatory agency databases
- Biographies of recent and relevant articles
- Non-English literature articles considered relevant and translated into English
- Publisher on-line table of contents services for the latest research articles
- Reports not yet submitted or papers in press to scientific peer reviewed journals obtained from individual researchers.

Databases scanned (from 1985 to the present) included Medline, Psychlit, Ergonomics Abstracts, CISDOC, HSELINE, MHIDAS, NIOSHTIC, RILOSH and BIDS and OSH-CD.

The extent of literature available on each factor considered in this study is highly variable. Where there are many studies reported in the literature it has not been possible, within the resources available, to provide a full and systematic appraisal. Thus reviews and examples of studies have been used to illustrate a number of the factors.

MUSCULOSKELETAL DISORDERS

Musculoskeletal disorders (MSDs) may affect the upper limbs (neck, shoulders, arms, hands, wrists and fingers), back and lower limbs (knees, hips, feet) and can result in debilitating pain, discomfort or numbness. MSDs arise in many forms and the symptoms are frequently non-specific. Some disorders classified as MSDs exhibit well defined signs and symptoms (e.g. carpal tunnel syndrome, tenosynovitis, tennis elbow), others are less well defined such as myalgic conditions involving pain and discomfort, numbness and tingling sensations throughout the neck, shoulders, upper limbs, lower back and lower limbs.

Musculoskeletal disorders are multi-factorial in aetiology and previous studies show it is necessary to take *physical* (heavy, static or monotonous work, extreme or constrained postures, repetitive movements, unsuitable workplaces and equipment, forces, exposure to vibration), *psychosocial* (work organisation, interpersonal relationships, short cycle tasks, poor work control, piece rate payment system, poor management, unsatisfactory training, lack of breaks) and *personal* (gender, age, seniority, exercise habits, life style, psychological characteristics and capacities) aspects into account as risk factors (Hales and Bernard, 1996; Bongers *et al.*, 1993; Hagberg 1988, 1992). Musculoskeletal symptoms may result from non-occupational (e.g. hobbies, sports activities) as well as occupational factors.

The science of ergonomics focuses on the interaction between physical, psychological and individual factors at the workplace. Ergonomics also acknowledges the influence of non-work factors. This enables the understanding of the complex determinants of health symptoms associated with work (Mergler, 1987).

Currently, there are no models of the relationship between musculoskeletal disorders and inequality. In the same way that the Armstrong *et al* (1993) model of possible causation of musculoskeletal disorders guided research into the development of the disorders, a similar model for inequality and musculoskeletal factors might now be required.

SOCIO-ECONOMIC MODEL OF HEALTH AND INEQUALITY

In the absence of a model specific to musculoskeletal disorders and inequality, the Dahlgren and Whitehead (1991) socio-economic model of health and its inequalities has been used to structure this review. The *Independent Inquiry into Inequalities in Health Report* (Acheson, 1998) also used this model (Figure1).

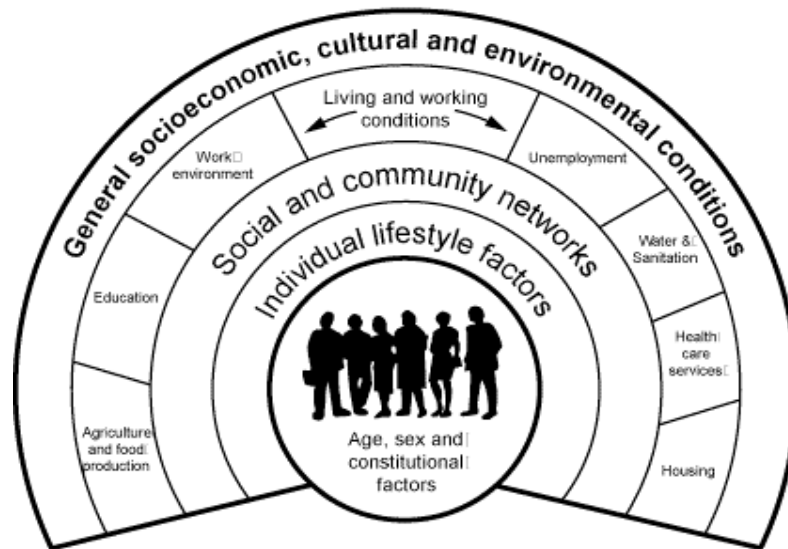


Figure 1
Socio-economic model of health and its inequalities
(Dahlgren & Whitehead, 1991)

The figure shows the main determinants of health as layers of influence. At the centre of the model, individuals are endowed with age, sex and constitutional factors that influence health potential. These factors are fixed. Surrounding the individuals are layers of influence that can be modified. The innermost layer represents the personal behaviour and way of life adopted (e.g. smoking habits and physical activity) with the potential to promote or damage health. Individuals interact with friends, relatives and the community and are affected by the social and community influences represented in the next layer. Mutual support within a community can sustain the health of its members in otherwise unfavourable conditions. The wider influences on a person's ability to maintain health include their living and working conditions, food supplies and access to essential goods

and services. Overall there are the economic, cultural and environmental conditions prevalent in society as a whole, represented in the outermost layer.

The model emphasises interactions between these different layers. For example, individual lifestyles are embedded in social and community networks and in living and working conditions, which in turn are related to the wider cultural and socio-economic environment.

Whilst all these areas are recognised as being of potential importance in defining and understanding the relationship between inequality and health in general, this review has found that there is often a paucity of evidence with respect to each area and musculoskeletal health.

Thus the factors considered here, whilst closely related to the model, do not enable an holistic picture to be drawn of inequality and musculoskeletal health. This absence of evidence should not be taken to mean "evidence of absence" but rather that further research may be required in some areas, particularly those known to be of importance for general health.

PROPOSED MAP OF POTENTIAL VARIABLES

A map of potential variables to be considered in the relationship between inequality and musculoskeletal disorders is put forward for future discussion (Figure 2). This map attempts to:

- include all the factors that could lead to inequality in musculoskeletal health;
- take a broader view of the influences on health and not just focus on workplace determinants;
- acknowledge the role of socio-economic, cultural and environmental, workplace, lifestyle, education, and physical and psychological loads by grouping factors under these headings;
- show that one factor does not necessarily lead to musculoskeletal problems but rather that there is likely to be an interaction between factors that could lead to musculoskeletal health inequalities.

Whilst all these variables are potentially important for musculoskeletal health, the focus for this work system oriented review has been on work factors, individual and education variables. The review does not consider physical workplace risk factors directly as these have been adequately covered in a number of recent reviews including NIOSH (1997), Buckle and Devereux (1999) and NAS (2001).

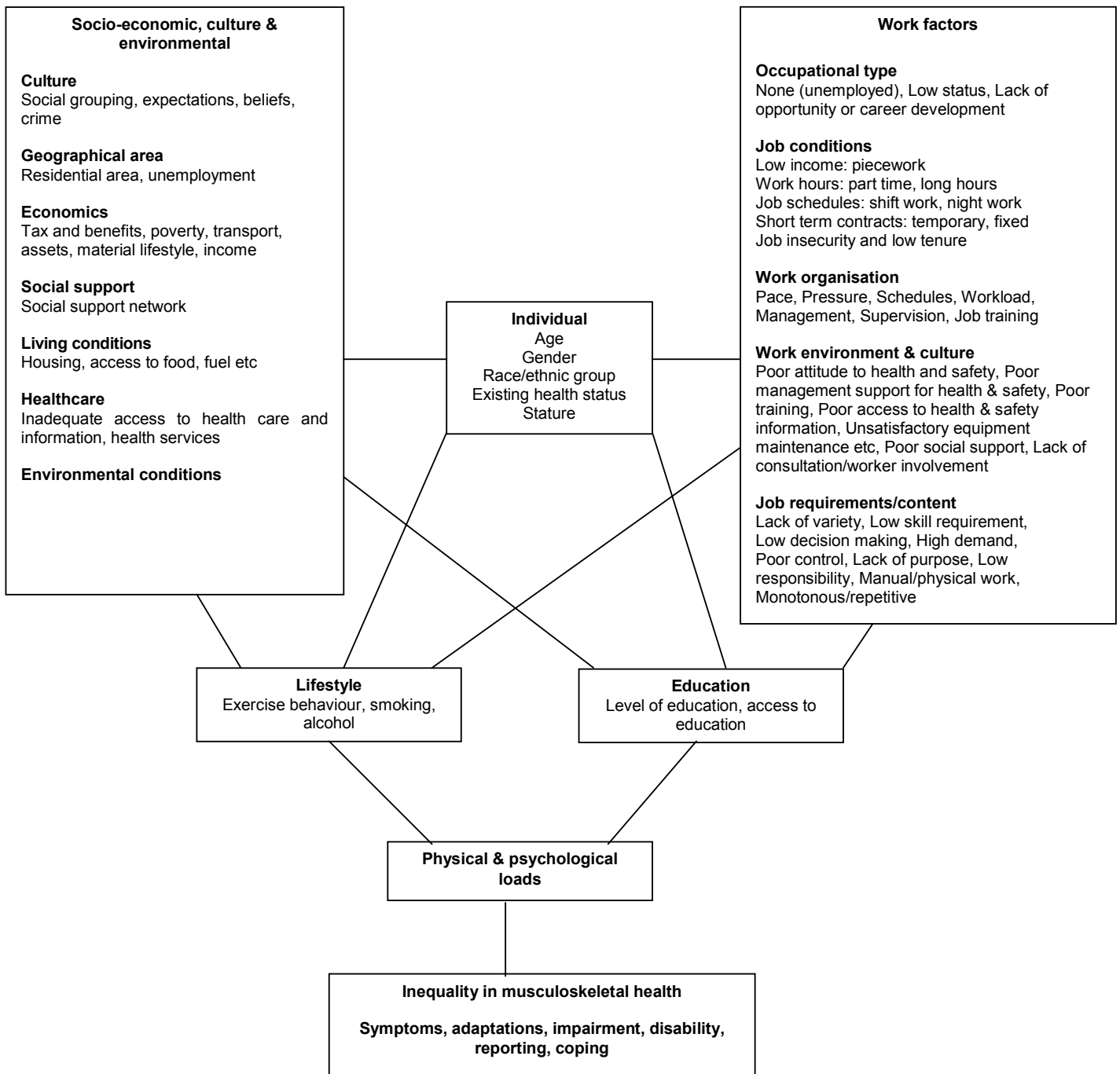


Figure 2:
Proposed map of potential variables in the relationship between inequality and musculoskeletal disorders (Woods and Buckle, 2001)

REPORT FORMAT

This review has focussed on the following factors and their association with inequalities in musculoskeletal ill health:

Section 1: Workplace factors

- Social support
- Access to health information
- Job insecurity, temporary and piece work
- Low status work
- Income

Section 2: Individual factors

- Education level
- Age
- Gender
- Ethnicity

Both sections are introduced by an outline of some of the main issues and concerns in the consideration of workplace and individual factors. Each factor has been reviewed separately, in order to examine its relationship to general ill health, followed by a consideration of its association with musculoskeletal ill health. An overview, highlighting areas for further research is provided.

LITERATURE REVIEW

Section 1 – Workplace factors

Introduction

In this section five workplace factors are reviewed with regard to their potential association with general and musculoskeletal ill health. Social support and access to health information are concerned with communication, relationships and organisational culture. Job insecurity, temporary and piecework, low status work and low income are conditions faced by the individual at the workplace.

In contrast to individual factors that are fixed, these workplace factors can be modified. Changes can be made to work schedules and to the provision of better access to information at work; in addition more support and better communication can be provided for the worker, to improve job conditions and to reduce their potential ill health implications for the worker.

None of these factors stand alone in their potential contribution to the development of musculoskeletal disorders. The interactive role of work demands, occupational stressors and ergonomic risk factors in musculoskeletal disorders remains unclear. There are many gaps in the literature and more prospective studies are required to determine and quantify causal relationships.

Social support

Summary

- Social support received at work from colleagues, supervisors or management has received some attention in the literature in relation to both general ill health and the occurrence of musculoskeletal problems. The studies have varied in their definition of social support at work. Lack of social support received away from the workplace may also be important but has received little attention as a risk factor for ill health.
- The findings from the majority of studies looking at mental and physical health indicate that a lack of social support from co-workers, supervisors or managers is a risk factor for ill health.
- The majority of studies investigating the association between social support and musculoskeletal symptoms show that poor social support is a risk factor for developing or reporting problems.
- A number of studies have recognised social support as an important strategy in coping with musculoskeletal disorders.

Social support and general ill health

According to Fox and Benzeval (1995) social circumstances are increasingly regarded as important causes of ill health but little research attention has been given to the role of social factors. They acknowledge that there is increasing evidence that factors such as social support, integration, isolation and social networks and roles are associated with health.

The variable 'poor social support' has been considered in a number of studies as a possible risk factor for the development of general ill health problems. As mentioned above, definitions of social support vary.

Three studies found the association between social support and health to be weak or non-specific (Dooley *et al.*, 1987; Aston and Lavery, 1993; Sheffield *et al.*, 1994). The findings from ten studies looking at different health outcomes (i.e. mental and physical health, stress, job burnout) indicate that a lack of social support from either co-workers, supervisors or managers appears to be a risk factor for ill health.

Mental and physical health

In a number of longitudinal studies, workers with high levels of social support at work showed less symptoms of anxiety (Morrison and Roberts, 1987) and less health problems (Stansfeld *et al.*, 1997; Marmot *et al.*, 1991). Blaxter (1997) using data on social relationships from the Health and Lifestyles survey found that both physical and psychological ill health were associated with low levels of social integration and support. Lundberg (1991) also found that weak social networks were important for mental ill health. More specifically a poor relationship with a supervisor was associated with health problems (Walters *et al.*, 1996).

Stress and job burnout

Warr (1994) and Vachon (1995) found that low social support along with other job characteristics were associated with stress and burnout. Burnout/emotional exhaustion were associated with low supervisor support among nurses (Robinson *et al.*, 1991) and low social support provided by friends and family among air traffic controllers (Dell'Erba *et al.*, 1994).

Social support was also recognised as a protective factor against ill health in five studies. Walters *et al.* (1996) found that enjoying a confiding relationship at work appeared to reduce health problems. Similarly, Stansfeld *et al.* (1997) found that high work social support predicted less health problems and was protective against spells of psychiatric absence. Social support at work was protective against mortality (Hibbard and Pope, 1992) and was an important predictor of those who remained in work for women (Lund and Borg, 1999). In a prospective study, Niemcryk *et al.* (1987) found co-worker amicability was significantly protective against illness and injury among air traffic controllers.

Social support and musculoskeletal ill health

The variable 'poor social support' has been considered as a possible risk factor in the development of musculoskeletal health problems. However as with the general health literature, it is important to recognise that the studies vary significantly in their definitions of social support (e.g. amicability with co-workers, good relationship with supervisor, good social support at work) and it is impossible to know if these various definitions of social support have the same meaning or importance for musculoskeletal ill health.

Of the many studies reviewed, only Vasseljen *et al.* (1995) reported that poor social support was not a predictor or associated with musculoskeletal symptoms and Skovron *et al.* (1987) found that recent lower back pain was significantly associated with satisfaction with co-workers relations among nurses.

Bongers *et al.* (1993) reviewed the epidemiological evidence and reported that lack of social support (from colleagues) was positively associated with musculoskeletal disorders. In addition, the findings from fourteen studies reported below investigated a wide range of workforces and job tasks (e.g. wood mill workers, tank terminal workers, journalists) and indicated that a lack of social support from either co-workers or supervisors was a risk factor for developing musculoskeletal ill health.

This was evident for studies looking specifically at back pain (Thorbjörnsson *et al.*, 2000; Hughes *et al.*, 1997; Skov *et al.*, 1996) and studies examining upper limb pain (Polanyi *et al.*, 1997; Linton and Kamwendo, 1989).

A number of studies that investigated the association of psychosocial characteristics of various jobs and lower back, neck and upper limb symptoms (Ahlberg-Hulten *et al.*, 1995; Faucett and Rempel, 1994; Linton, 1990)

identified low social support from co-workers and/or supervisors as a factor that was associated with or increased the risk for symptoms.

Studies focussing on general musculoskeletal discomfort also recognised the importance of social support in the development of these problems (Baker *et al.*, 1999/2000; Toomingas *et al.*, 1997; Burdorf *et al.*, 1997). Leino and Hanninen (1995) found that poor satisfaction with social relations at work was an antecedent to an increase in musculoskeletal morbidity. Results also showed a change in clinical findings in the low back as well as in the morbidity of the neck, shoulder, upper and lower limbs, was predicted by the quality of social interaction at work.

Good social support was highlighted as a potential protective factor against musculoskeletal ill health (Fjellman-Wiklund and Sundelin, 1998; Punnett, 1994; Faucett and Rempel, 1994). Similarly, Krause *et al.* (1997) found that the ability to communicate with fellow workers and social support received from supervisors reduced the risk of disability retirement. For those already with problems, good social support was considered important in coping with musculoskeletal symptoms (Torp *et al.*, 1999; Kemmlert *et al.*, 1993) and with motivation for change in patients with prolonged musculoskeletal disorders (Grahm *et al.*, 1999).

The majority of studies indicated that a lack of social support whether from co-workers, supervisors or managers is a risk factor for general and musculoskeletal ill health. When people have musculoskeletal problems at work or are returning to work after problems, social support has been identified as important in their coping strategy. Clearer definitions are required for social support in future research.

Table 1: Summary of research studies on social support and musculoskeletal ill health

Social support	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Skovron <i>et al.</i> , 1987	Low back pain and work organisation among nurses	Prospective epidemiological	Low back (LBP)	Recent low back pain (in last 6 months)	Associations with low back pain: younger age, satisfaction with work colleagues, being a registered nurse. 43% low back pain sometime in past; 28% reported episodes of more than 3 days; 20% reported at least 1 episode in last 6 months	Yes but with good social support		Self report questionnaire	controlled job category, a small positive association between satisfaction with co-workers and previous LBP remained
Linton and Kamwendo, 1989	Risk factors in psychosocial environment for neck and shoulder pain in secretaries	Cross-sectional	Neck and shoulder pain	Last year	A poor psychological environment related to frequency of neck and shoulder pain. RR for frequent neck pain was 2.85 (1.28-6.32) and shoulder pain 3.32 (1.53-7.2). Work content and social support at work related to pain but no clear relationships identified for job demands	Yes		Questionnaire	
Linton, 1990	Risk factors (lifestyle, ergonomics, psychosocial work place factors) for MSD in Sweden	Cross sectional study of 22, 180 employees	Neck and low back	Last year	31% neck pain and 18% consulting doctor; 39% back pain and 16% consultation. Age was a factor for prevalence of neck and back pain. Not eating regularly and smoking increased risk for ill health. Lifting, monotonous tasks, vibration, uncomfortable postures were the most important ergonomic factors. A poor psychological environment (work content and social support in particular) increased risk (OR 1.6-3) except for the oldest category; the youngest group had highest odds ratios. Poor psychological environment/exposure to one ergonomic factor - highest risk (OR 2.4-3.6)	Yes	Prevention programmes should be broad based and include psychosocial as well as ergonomic measures	Questionnaire completed as a result of routine examinations at occupational health services	
Bongers <i>et al.</i> , 1993	Psychosocial factors at work and MSD	Qualitative review of the epidemiological literature	General MSD but particularly back, neck and shoulders	————	Reviewed studies do not present conclusive evidence due to high correlations between psychosocial factors and physical load and to difficulties in measuring independent and dependent variables. The data suggested that low job control and lack of social support from colleagues were positively associated with musculoskeletal disease. Perceived stress may be intermediary in this process. Concluded that monotonous work, high perceived workload and time pressure were related to musculoskeletal symptoms.	Yes			

Social support (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Kemmlert <i>et al.</i> , 1993	Current status of health, well being and functional capacity of those with occupational over exertion injuries in a previous study	Three-year follow-up	General MSD	Current	Higher prevalence of physical and psychological symptoms than normal population. More than 50% reported difficulties in activities of daily living. Almost one third of the sample had changed occupations and had more varied tasks. Those with reduced workloads did not report less MSD.	_____	Access to social support was positively related with health and psychological well-being.	Questionnaire	
Faucett and Rempel, 1994	VDU work, MSD, posture and psychosocial factors in a newspaper editorial department	Cross-sectional	General MSD	59% pain in last week	More hours per day on VDU and less decision making were significant risk factors for potential MSDs. Workstation factors (e.g. keyboard height) significantly related to more pain in shoulders, neck and upper back. Lower levels of social support associated with severe hand and arm numbness.	Yes	Symptoms severity modified by psychological workload, decision making, employee relationship with supervisor.		
Punnett, 1994	Risk factors for injury in a sawmill industry	Case control cross-sectional study	General MSD injury		Cases were more likely than controls to be employed in machine paced jobs, exposed to dangerous work methods and materials, experience louder noise levels and faster work pace, have higher lifting demands and more frequent postural stress, experience lower decision latitude and lower social support at work. Being male, being one year or less in the job, inability to take a break when tired were also significantly associated with injury occurrence.	Yes	Decision latitude and social support had small protective effects.	Cases identified by compensation commission. Interviews	
Vasseljen <i>et al.</i> , 1995	Individual, psychological and psychosocial risk factors for MSD in manual (n=15 pairs) and office work (n=24 pairs) settings	Case control cross-sectional study	Neck and shoulder		Perceived general tension was most strongly associated with pain in both work groups. Otherwise results in the two groups were very different. Social support, job pressure and job contentment were not shown to be significant predictors of pain in either work group.	No		Questionnaires and interviews	

Social support (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Ahlberg-Hulten <i>et al.</i> , 1995	Perception of social support, job strain and musculoskeletal pain in female health care personnel	Cross-sectional study – results based on two studies	Low back, neck and shoulders	In last month	None of the non-work factors (age, number of children or habitual status) had a significant effect on MSD. Psychological demands, authority over decisions, skill utilisation and support at work had a statistically significant effect on lower back symptoms while neck and shoulder symptoms were associated with social support at work. Multivariate logistic regression showed different associations: higher the strain, the more symptoms in the back. Neck and shoulder pain more associated with low social support at work/relational and emotional factors.	Yes		Questionnaire	
Leino and Hanninen, 1995	Association between work control, social relationships, mental strain, physical workload and musculoskeletal morbidity	10 year follow-up prospective study of metal workers (n= 902 blue and white collar workers)	Neck, shoulders, upper limbs, lower back and lower limbs		Pain in different parts of the musculoskeletal system was associated with psychosocial factors at work, suggesting a general MSD responsivity to mental stress. The associations were independent of physical workload. Prospectively, social relations and work content scores predicted change in several morbidity scores. Changes in clinical findings were predicted by quality of social interaction at work.	Yes		Questionnaire, interviews and clinical exam	Controlled for age, gender, social class and physical workload
Skov <i>et al.</i> , 1996	Psychosocial and physical risk factors for MSD	Cross-sectional study of 1306 sales workers	Neck, shoulder and lower back		Both psychosocial and physical factors were associated with MSD. High job demands were related to neck and shoulder symptoms and a tendency to become overworked. Lack of social support from colleagues was related to back pain.	Yes		Self report questionnaire	
Krause <i>et al.</i> , 1997	Predictors of disability retirement – role of physical and organisational work conditions, perceptions of job strain, job dissatisfaction and social support	Prospective population based study of 1038 Finnish men in a heart risk study	General MSD and disability retirement	Only those disabled and retired at time of follow-up but not at beginning were included	Various job characteristics predicted disability retirement: heavy work, work in uncomfortable positions, working in isolation, long work hours, noise at work, physical job strain, musculoskeletal strain, repetitive or continuous muscle strain, mental job strain and job dissatisfaction. The strong association between workplace factors and the incidence of disability retirement link the problem of disability retirement to poor work conditions. 15% new cases of disability retirement in follow-up study.	—	The ability to communicate with fellow workers and social support from supervisors tended to reduce the risk of disability retirement	4 year follow-up examination and questionnaire	The relationships persisted after control for socio-economic factors, prevalent diseases and health behaviour.
Toomingas <i>et al.</i> , 1997	Associations between psychosocial factors and MSD	Cross-sectional study of 358 people	General MSD	Current	Low social support at work, high psychological demands and job strain were associated with MSD symptoms and signs. Decision latitude at work showed few associations with musculoskeletal disorders.	Yes		Self report questionnaire, medical examinations	Controlled for age, gender, and physical load

Social support (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Polanyi <i>et al.</i> , 1997	Prevalence and associations of upper limb problems	Cross-sectional survey of 1306 newspaper personnel in Canada	Upper limb	20% reported moderate or worse ULDs monthly or lasting more than a week in last year.	Those facing frequent deadlines, high psychological demands (fast work pace, conflicting demands), had low skill discretion and social support, spent more time keyboarding, or had computer screen in non-optimal positions were likely to report moderate to severe symptoms. Women reported significantly higher levels of symptoms than men.	Yes			
Hughes <i>et al.</i> , 1997	Prevalence of MSD and their association with physical and psychosocial characteristics of jobs	Cross-sectional study in an aluminium smelter	Upper limb and back		Years of forearm twisting were found to be a significant predictor for upper limb disorders. Low decision latitude was a significant predictor for shoulder pain. High job satisfaction (OR=5.9, 95% CI=1.4-25) and low social support (OR = 5.3, 95% CI=1.3-22) were associated with low back pain.	Yes		Structured interview, physical exam and questionnaire	
Burdorf <i>et al.</i> , 1997	Physical load as a risk factor for MSD among tank terminal workers – development of an assessment strategy	Cross-sectional study of operators, n=77, office workers n=52, and misc n=15	General MSD	Pain that had persisted for at least a few hours in the last 12 months	High prevalence of MSD in all 3 groups although operators were at higher risk of pain in the neck, shoulder, elbow, wrist and knee when compared to office workers. After adjustment for age and other confounders the observed work time with trunk rotation and flexion was associated with back pain. Lack of social support at work and heavy physical labour in previous jobs increased the frequency of musculoskeletal complaints.	Yes		Standardised interview, direct observation, self completed diaries	Adjusted for age and other confounders
Fjellman Wiklund and Sundelin, 1998	MSD among music teachers	Eight-year prospective study	Neck, lower back and upper limbs		Music teachers often experience discomfort in the neck, shoulders and low back of long duration, increasing over the years. Psychosocial environment characterised by high psychological demands and low authority over decisions but compensated for by good social support. The work required skill and creativity but was also monotonous.	—————	Good social support compensated for poor psychosocial environment	Questionnaire and measurements of arm elevation	

Social support (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Grahn <i>et al.</i> , 1999	Motivation for change in patients with prolonged MSD	Qualitative follow-up case studies	MSD disability	Prolonged over 2 year study	Utilisation of professional networks (i.e. healthcare, regional social insurance office), emotional support (i.e. nuclear family, close relatives), use of personal coping resources (i.e. positive beliefs, problem-solving) and social support at work (i.e. employers, colleagues) were considered important for motivation to change.	_____	Social support important for motivation to change	Interview	
Torp <i>et al.</i> , 1999	Psychosocial work environment and coping with MSD	Cross-sectional of 103 of motor mechanics	General MSD	Last year	Positive, significant relationships were identified between how mechanics coped with MSD and psychosocial factors: work demands, social support, control, manager's involvement in health and safety work, and whether the garages had regular meetings between management and workers.	_____	Social support important for coping	Questionnaire	
Baker <i>et al.</i> , 1999/2000	Background factors, work practises and psychosocial variables and musculoskeletal discomfort	Cross-sectional study of 155 customer service representatives	Last 12 months and last 7 days	Back and upper limb and neck	93% reported musculoskeletal discomfort in some body part. The amount of social support, job variety and skill utilisation in the job were the psychosocial variables most often associated with musculoskeletal discomfort (apart from the neck).	Yes		Self report questionnaires	
Thorbjörnsson <i>et al.</i> , 2000	Physical and psychosocial occupational factors related to low back pain	Longitudinal	Low back	24 year follow-up	Factors at work were risk indicators for low back pain for both genders: low influence over work conditions, heavy physical workload, sedentary work, smoking among women and poor social relations at work, heavy physical workload, sedentary work, high perceived load outside work and combination of poor social relations and overtime among men, in combination with other factors.	Yes			

Access to health information/education at work

Summary

- The importance of access to information that promotes healthy working practises either at work or in the community may have a role in musculoskeletal ill health in terms of development, reporting or coping with a problem. However there are very few studies in this area.
- Modern approaches to ergonomic interventions have shown the importance and value of a participatory approach (Haines and Wilson, 1998). Such an approach involves facilitation, access to information and appropriate worker participation.
- The evidence suggests that the role of health information and education within such an intervention strategy is important. Informed interventions need further research.

Access to health information and general ill health

No studies were found that investigated the effect of poor access to health information at work on ill health.

Access to health information and musculoskeletal ill health

A report from the Occupational Health Services Working Group (OHSWG, 2000) of the Occupational Health Advisory Committee (OHAC) investigated how to improve access to occupational health support, particularly for people at work in small and medium enterprises. This reflects concern that lack of access to occupational health support contributes to health inequalities within the adult population. The main conclusions reached by OHSWG are:

- prevention of ill health at work and amelioration of the effects of health on work (e.g. through rehabilitation) are essentially management issues and whilst professional occupational health support may be required, this is not inevitably the case in all circumstances. The key will be to ensure that employers and managers have access to a point of enquiry that can either suggest solutions or signpost employers and managers to the appropriate level of advice;

- strategies to remove occupational health inequalities and improve access to occupational health support will not succeed unless further action is taken to improve employer and worker awareness of when such support is needed;
- delivery mechanisms for occupational health support should give priority to the prevention of health risks at work and the issues that arise from the effects of health on work (e.g. non-work related illness compounded by work and rehabilitation);
- there is no one solution that will meet the occupational health support needs of everyone; flexibility is the key to delivery mechanisms;
- there is a wide range of mechanisms, many involving partnerships, that should be pursued to raise awareness of occupational health issues, and encourage and facilitate the delivery and use of occupational health support.

The term *occupational health* conveys different meanings to different people. For some, it means simply the prevention and treatment of illness that is directly related to work, in which health education has no place. Others will emphasise fitness for work issues separately from health and safety. Health inequalities stem from a complex interaction between low income, employment status (or lack of it), socio-economic class, education, standard of housing and other environmental factors (OHSWG, 2000). Neither prevention of work-related ill health nor workplace advice on healthy living can deliver all the solutions to health inequalities amongst the adult population. Even where there is occupational health support, people may not know how to make use of it.

Fives studies reviewed have considered the importance of ergonomics training programmes and the approach undertaken in providing ergonomics information (King *et al*, 1997; Marcotte, 1991; Silverstein *et al*, 1991; Dyer and Morris, 1990; Shahnava, 1987). Modern approaches to ergonomic interventions have shown the importance and value of a participatory approach (Haines and Wilson, 1998). Such an approach involves facilitation, access to information and appropriate participation. The evidence suggests that the role of health information and education within such an intervention strategy is important.

Two training programmes reported success in reducing the occurrence of musculoskeletal problems (Chavalinitikul *et al*, 1995; Marcotte, 1991) and harmful postures and ergonomic errors in nursing (Engels *et al.*, 1997), and therefore had potential to reduce the occurrence of injury and pain. However one health care programme designed to decrease the incidence of disability as a result of musculoskeletal injury was unsuccessful (Verbeek *et al.*, 1993). This was explained by a lack of motivation among management and a separation of policy on worker health from overall company policy.

Type of worker beliefs and attitudes about back pain may influence the development of chronic back disorders and work loss (Symonds *et al.*, 1995). An intervention study conducted to establish the effectiveness of educational material about low back pain on various psychosocial parameters and

absenteeism (Symonds *et al.*, *ibid*). A significant reduction in sickness absence and a positive shift in beliefs concerning the locus of pain control and the inevitable consequences of low back trouble was found. The importance of access to appropriate educational resources and materials would therefore seem evident, especially where confronting lay beliefs and attitudes.

The success of providing information that promotes healthy working practises either at work or in the community in terms of reducing musculoskeletal ill health is an under researched area. However, there is support from the studies reviewed that provision of ergonomics and health and safety information is important. More investigation of the ways in which health information (other than occupational health provision) is provided and managed and how successful this is in preventing ill health is required.

Table 2: Summary of research studies on access to health information and musculoskeletal ill health

Access to health info	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders/outcome of study	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method
Shahnavaz, 1987	Workplace injuries in developing countries (DCs)	Discussion document	General MSD and injuries	_____	Poor working conditions and ineffective injury prevention programmes lead to high sickness and accident rate in DCs. Salary and social benefits are low; this results in malnutrition and low work capacity and greater vulnerability to disease and accidents.	_____	Need to take account of users and environment and provide workforce with better understanding of technology transfer problems.	Observation
Dyer and Morris, 1990	Human aspects of library automation	Review of research	General ergonomics	_____	Importance of management of change, planning and implementation in informing/training employees in alternatives work conditions (e.g. workstation design, variation in job procedures, software interface usability) to try and reduce ergonomic problems.	_____		
Silverstein <i>et al.</i> , 1991	Evaluation of a factory ergonomics training	Training intervention	General MSD	_____	Trial of 'train the trainer' programmes to provide ergonomic trainers. Ergonomic knowledge increased as a result of the course. Trainee course satisfaction, ergonomics knowledge and performance did not differ from those trained by university instructors.	_____		
Marcotte, 1991	Implementing ergonomics training using in-house personnel	Training intervention	General MSD	_____	Different levels of training given to 2 groups (basic ergonomics to identify potential causes/prevention of injury and more detailed ergonomics methodology). Decrease in injuries, increase in production, improvement in work attitudes for those trained by both groups.	Yes Improved after training		
Verbeek <i>et al.</i> , 1993	Evaluation of occupational health care programme - incidence of MSD disability	Training intervention among refuse collectors	MSD disability		Only 3 of the 10 preventive measures were reached. Explained by lack of motivation among management and separation of policy on worker health from overall company policy.	No		
Chavalinitikul <i>et al.</i> , 1995	Effect of ergonomics training on postures, back pain, back strength in workers lifting heavy objects	Training intervention	Back	Current	Back pain experienced by up to 40% before training and by 25% after. Decrease in back strength in control group. Lifting methods should be compatible with actual working environment.	Yes Improved after training		Interview, observation and back strength testing

Access to health info (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders/outcome of study	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method
Symonds <i>et al.</i> , 1995	Effects of an educational pamphlet on altering avoidance behaviour and reducing absenteeism from low back trouble	One year prospective study at 3 factories - intervention	Low back pain	Absence data over 4 years	Significant reduction in number of spells with extended absence and number of days of absence. A positive shift in beliefs was seen for locus of pain control and inevitable consequences of low back trouble.	_____		Questionnaire and absence data from company records (collected for 4 years before intervention and 1 year after)
King <i>et al.</i> , 1997	Impact of 3 ergonomics training methods in manufacturing industry	Training intervention	_____	_____	Lectures supplemented by ergonomic job redesign and participatory training were effective in altering worker safety behaviours. This training had a significant effect on ergonomics knowledge, job satisfaction, recognition and reporting of hazards.	_____		
Engels <i>et al.</i> , 1997	Development of ergonomics program to prevent MSD	Training intervention among nurses	General MSD	_____	The 'train the trainer' concept was used in the ergonomics education program. A survey of harmful postures and ergonomic errors revealed that nursing performance improved substantially following the intervention.	Yes Improved after training	questionnaire	
Haines and Wilson, 1998	Framework for participatory ergonomics interventions	Literature review development of definitions and framework	_____	_____	A participatory approach involves facilitation, access to health information/education and appropriate participation.	_____		

Job insecurity, temporary contract work, piecework

Summary

- Along with greater labour market flexibility and deregulation of employment contracts has come greater job insecurity. While all sections of the workforce have been affected by these trends, less skilled manual workers at the lower end of the labour market have been affected the most, in terms of greater exposure to low paid, temporary and insecure employment (Acheson, 1998).
- Studies on job insecurity have been grouped together in this section with studies on temporary contract and piece work.
- The studies looking at these job conditions indicate that they are a risk factor for ill health.
- The findings from the small number of studies on job insecurity, temporary and piece work indicate an association of these job conditions with an increase in musculoskeletal ill health.

Job insecurity, temporary contract work, piece work and general ill health

The variable 'job insecurity' has been considered in a number of studies as a possible risk factor for the development of general health problems. While one study indicated that job security was not related to psychiatric distress in fulltime, male and female dual earner couples (Barnett and Brennan, 1995), ten studies found job insecurity was a risk factor for or associated with ill health.

Job insecurity was a risk factor for or associated with ill health in a number of studies (Ferrie *et al.*, 1995; Triolo, 1989; Dooley *et al.*, 1987); similarly Smith (1997) identified fear of job loss as an important psychosocial aspect of working with computers and physical and mental health.

Extended periods of job insecurity decreased job satisfaction and increased physical symptoms in automotive workers (Heaney *et al.*, 1994). This study indicated that job insecurity acted as chronic stressor with effects becoming more potent as the time of exposure increased.

Thomas (1997), studying management strategies for stress in mental health nursing, identified increased workloads, understaffing, job insecurity and organisational change as major stressors. Bussing (1986) and Murphy (1991) indicated more distress and diminished job satisfaction occurred as a result of job insecurity and Warr (1994) found job insecurity was associated with stress and burnout. In a review of research on the psychological consequences of job insecurity De Witte (1999) found that job insecurity reduced psychological well-being and job satisfaction and increased psychosomatic complaints and physical strains.

The findings from studies looking at mental health and piece work (Nadeau *et al.*, 1990), unpaid work (Arber and Lahelma, 1993) and part-time work (Arber and Lahelma, 1993; Ross and Bird, 1994) have found that these job conditions were associated with ill health among female workers. Temporary workers suffered more from severe occupational injuries than permanent staff Francois (1991).

Job insecurity, temporary contract work, piece work and musculoskeletal ill health

The findings from six studies looking at insecure, temporary and piece work working conditions show an association between job conditions and musculoskeletal disorders.

One study on job insecurity identified an increase in pain symptoms with less job security among female computer users (Marcus and Gerr, 1996). A further study (Camerino *et al.*, 1999) found a significant relationship between past history of episodes of acute low-back pain and job insecurity.

Part-time work along with other occupational exposures (e.g. standing continuously) increased the risk for musculoskeletal ill health among female warehouse workers (Kondo *et al.*, 1989).

Piecework was associated with musculoskeletal disorders (Moure-Eraso *et al.*, 1997) and the duration of the piecework was associated with the severity of disability (Vezina *et al.*, 1989; Vinet *et al.*, 1989).

The findings of the studies that have investigated job insecurity, temporary, part time and piece work show that these job conditions have an effect on musculoskeletal ill health. The interaction of gender with these job conditions may also be important in the development of musculoskeletal ill health as the majority of the studies have been conducted on female workers. Job insecurity is under researched. Current economic trends suggest that further research to establish the problems of insecure job conditions is required.

Table 3: Summary of research studies on job insecurity, temporary contract work, piece work & musculoskeletal ill health

Job insecurity	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Vezina <i>et al.</i> , 1989	Premature ageing among piecework female garment workers	Longitudinal data analysis and cross-sectional follow-up of 800 females	General MSD Permanent / chronic disability	12months prior to interview	Twice as many cases of severe disability among those paid on hourly basis. Duration of employment in piecework associated with severe disability	Yes		Yearly data from public agency data for 30 year period and interviews	Age, task type and smoking
Vinet <i>et al.</i> , 1989	Duration of employment among female garment workers	Longitudinal data analysis	General MSD		Duration of piecework associated with prevalence of severe MSD disability, independent of smoking, age, education, task type length of employment.	Yes		Analysis of public agency data	
Kondo <i>et al.</i> , 1989	Workload and MSD among female warehouse workers	Cross-sectional study of 1268 part-time workers	Back and upper limbs	Pain at end of day and those that sought help	High degree of muscular strain in shoulders and back; fatigue in neck and upper limbs at end of day. Part-time work, continuous standing and frequent repetitive postures increased risk for MSD.	Yes		Questionnaire survey	
Marcus and Gerr, 1996	MSD, computer use and psychosocial stress among female office workers	Cross-sectional	Neck and shoulder	Two weeks	Significantly increased odds ratios for symptoms for subjects who had ever used a computer, had less job security and had more stressful work	Yes			
Moure-Eraso <i>et al.</i> , 1997	Sweatshop working conditions in Mexico	Cross-sectional	General MSD		Workers (81% female) reported MSD related to working conditions. Prevalence of symptoms correlated with increased duration of exposure to ergonomic risk factors.	Yes		2 questionnaire surveys of workers and community leaders	
Camerino <i>et al.</i> , 1999	Psychosocial factors and manual handling risks for nurses in a hospital	Cross-sectional	Back	Past history and last 12 months	Past history of episodes of acute low back pain associated with limited decision making and job insecurity; episodes of acute low back pain in the last year associated with low discretion at work	Yes		Observation and questionnaire	

Low status work

Summary

- Employment plays a fundamental role in our society. People are often defined, and define themselves, through what they do for a living. Sociological studies emphasise that not only is employment a primary source of status but is also significant in providing purpose, income, social support, structure to life and a means of participating in society (Acheson, 1998).
- The Black report (1980) found that the poorer health experience of lower occupational groups applied at all stages of life. Surveys that ask about self-perceived pressure of work have found that people in higher socio-economic groups report pressure more frequently. However, evidence of health related harm is associated more with specific psychosocial factors such as imbalance between psychological demands and control and lack of control at work. Exposure to high demand and low control is more common among lower socio-economic groups (Acheson, 1998).
- The 1995 Labour Force Survey figures show that blue collar workers experience more injuries at work and work-related ill health than white collar workers. Manual workers, along with nurses are more likely to have left their jobs through work-related ill health than non-manual workers.
- For this review, 'low status' work has been taken to mean unskilled, paced, or repetitive work; jobs where no training is required; where there is a low requirement to make decisions; low pay; or low control over the job.
- A sample of studies looking at low status jobs shows an association with ill health.
- All studies reviewed have indicated that jobs of lower status are a risk for the development of musculoskeletal disorders.

Low status work and general ill health

The variable 'low status work' has been considered in a number of studies as a possible risk factor for the development of general health problems.

Studies have shown an association between physical ill health and conducting lower status jobs in an organisation (Marmot *et al.*, 1991), conducting dull, monotonous work under pressure with low control over the job (Marmot *et al.*, 1997; Pickett and Lees, 1991) and occupational class and employment status (Arber and Lahelma, 1993). On the other hand, a combination of high control and high demand was found to be protective against heart disease in blue collar workers (Steenland *et al.*, 1997) and ill health in health service employees (Rees and Cooper, 1992).

A sample of studies has shown an association between mental ill health (including stress and emotional exhaustion) and low decision latitude in nurses (Robinson *et al.*, 1991) and hospice staff (Vachon, 1995) and in the perception of poor treatment by emergency staff and low appreciation of their job skills (Neale, 1991). Further studies confirmed the findings that the effect

of doing dull, monotonous work, working under pressure and conflicting demands were associated with psychiatric distress in fulltime, male and female dual earner couples (Barnett and Brennan, 1995) and among blue-collar workers (Lundberg, 1999).

Low status work and musculoskeletal ill health

The variable 'low status work' has been considered in many studies as a possible risk factor for the development of musculoskeletal health problems.

In a review of the epidemiology literature, Bongers *et al* (1993) concluded that low job control, monotonous work, high perceived work load and time pressure are related to musculoskeletal symptoms.

Higher risk and greater incidence of musculoskeletal disorders was associated with conducting paced, repetitive work with poor postures (Putz-Anderson, 1988; Kondo *et al.*, 1989; Krapac *et al.*, 1992) and blue-collar work (Leino *et al.*, 1988; Andersson *et al.*, 1993; Arndt *et al.*, 1996)

Ahlberg-Hulton *et al* (1995) found that authority over decisions and skill utilisation had a significant and positive effect on lower back symptoms among female health carers. A higher prevalence of musculoskeletal problems was also evident in workers (e.g. data entry operators, warehouse workers) in jobs with low decision making and skill use (Thorbjörnsson *et al.*, 2000; Baker *et al.*, 1999/2000; Woods *et al.*, 1999; Hughes *et al.*, 1997; Polyani *et al.*, 1997; Leino *et al.*, 1988; Chau *et al.*, 1995; Faucett and Rempel, 1994; Seitsamo *et al.*, 1994; Chiang *et al.*, 1993; Hodgson *et al.*, 1993; Gun, 1990; Krapac *et al.*, 1985). In contrast, Toomingas *et al* (1997) found that decision latitude at work showed few associations with musculoskeletal disorders.

Three studies showed more frequent absence due to musculoskeletal problems among low skill or lower grade employees (Feeney *et al.*, 1998; Stürmer *et al.*, 1997; Krapac *et al.*, 1985). The frequency of radiating pain was found to decrease in proportion with the degree of work qualification (Krapac *et al.*, *ibid*).

The majority of studies reviewed indicated that jobs of lower status are a risk factor for the development of musculoskeletal disorders. Standardised terms and definitions are required. These require validation and application in future epidemiological studies of musculoskeletal disorders.

Table 4: Summary of research studies on low status work and musculoskeletal ill health

Low status	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Krapac <i>et al.</i> , 1985	Spine pain among various skilled railway workers	Cross-sectional	Back		Absence more frequent among unskilled and semiskilled workers and among young. Frequency of radiating pain decreased in proportion with degree of work qualification.	Yes			
Putz-Anderson, 1988	Automation impact on MSD in assembly line work		General MSD		Risk associated with repetitive, machine pace work, awkward postures and excessive hand force.	Yes			
Leino <i>et al.</i> , 1988	Occupational class, physical workload and MSD in engineering	Longitudinal	General MSD		MSD more frequent among male and female blue collar workers than in respective white-collar groups and increase in morbidity over time higher in blue collar. Physical strain and physical load negatively associated with incidence of long-term MSD in blue collar female.	Yes		Interview/observation, clinical exam	
Kondo <i>et al.</i> , 1989	Workload and MSD among female warehouse workers	Cross-sectional study of 1268 workers	Back and upper limbs	At end of day and those that had sought medical help	High degree of muscular strain in shoulders and back; fatigue in neck and upper limbs at end of day. Part-time work, continuous standing and frequent repetitive postures increased risk for MSD.	Yes		Questionnaire survey	
Gun, 1990	Incidence and distribution of RSI in Australia	Analysis of data form various surveys	Upper limb		High prevalence of RSI in blue collar workers. Higher prevalence among women in all occupational and industrial categories. Groups most at risk are female workers performing unskilled unfulfilling tasks.	Yes	Interventions of benefit to keyboard operators have not improved the situation for female blue collar workers		
Krapac <i>et al.</i> , 1992	Cervicobrachial syndrome and work disability	Case control cross-sectional study of 114 people	Upper back	Current	Cervicobrachial syndrome was highly prevalent among unskilled workers (32%) and among those conducting work requiring force postures and repetitive movements.	Yes		Clinical examination Standardised questionnaires	
Chiang <i>et al.</i> , 1993	Prevalence of ULD and associated ergonomic risk factors among fish processing workers	Cross-sectional study of 207 workers in 8 factories	Upper limb	Current and last 30 days	Shoulder girldle pain, epicondylitis and CTS most common disorders. Untrained and unskilled workers suffered more MSD.	Yes		Interview, job analysis and medical check-up	

Low status (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Hodgson <i>et al.</i> , 1993	Perception of work and health	Cross-sectional study	General MSD	Last 12 months	Self-reports of musculoskeletal conditions far exceeded any other disease category. The occupations reporting the highest overall rates of work-related illness were coal mining, construction, metal and electrical processing, transport and materials moving and unskilled labourers.	Yes		Questionnaire	
Andersson <i>et al.</i> , 1993	Geographical area, age, gender, social class and chronic pain	Cross-sectional epidemiological study	Neck, back, upper and lower limbs	Chronic pain greater than 3 months (55%) and 49% lasting 6 months	Prevalence of pain increased with age up to 50-59 then decreased. High prevalence of chronic pain in general even among young. Women more multiple pain locations and higher prevalence in certain areas. Prevalence higher in blue collar workers.	Yes	13% with reduced functional capacity (mainly blue collar)	Self report questionnaire mail survey	
Bongers <i>et al.</i> , 1993	Psychosocial factors at work and MSD	Qualitative review of the epidemiological literature	General MSD but particularly back, neck and shoulders	—	Reviewed studies do not present conclusive evidence due to high correlations between psychosocial factors and physical load and to difficulties in measuring independent and dependent variables. The data suggested that low job control and lack of social support from colleagues were positively associated with musculoskeletal disease. Perceived stress may be intermediary in this process. Concluded that monotonous work, high perceived workload and time pressure were related to musculoskeletal symptoms.	Yes			
Faucett and Rempel, 1994	VDU work, MSD, posture and psychosocial factors in a newspaper editorial department	Cross-sectional	General MSD	59% pain in last week	More hours per day on VDU and less decision making were significant risk factors for potential MSDs. Workstation factors (e.g. keyboard height) significantly related to more pain in shoulders, neck and upper back. Lower levels of social support associated with severe hand and arm numbness.	Yes	Symptoms severity modified by psychological workload, decision making, employee relationship with supervisor.		
Seitsamo <i>et al.</i> , 1994	Incidence and predictors of sciatica in older workers	4 year follow-up of 4863 workers	Back	4 year cumulative incidence	4 year cumulative incidence was 8.7%; highest incidence (11.2%) occurring among unskilled workers and the lowest (6.2%) among professionals/executives. Different predictors were identified for gender.	Yes			

Low status (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD/ability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Ahlberg-Hulten <i>et al.</i> , 1995	Perception of social support, job strain and musculoskeletal pain in female health care personnel	Cross-sectional study – results based on two studies	Low back, neck and shoulders	In last month	None of the non-work factors (age, number of children or habitual status) had a significant effect on MSD. Psychological demands, authority over decisions, skill utilisation and support at work had a statistically significant effect on lower back symptoms while neck and shoulder symptoms were associated with social support at work. Multivariate logistic regression showed different associations: higher the strain, the more symptoms in the back. Neck and shoulder were more associated with low social support at work/relational and emotional factors.	Yes		Questionnaire	
Chau <i>et al.</i> , 1995	Implications of ULD on occupational activities	Cross-sectional study	Hand	Current injuries	Excess work injuries among unskilled workers and younger workers. High frequency of injured had both work and domestic demanding activities.	Yes			
Arndt <i>et al.</i> , 1996	MSD and other health problems among construction workers	Longitudinal	General MSD		Compared with white collar workers, a higher prevalence of hearing deficiencies, signs of obstructive lung diseases, increased body mass index and musculoskeletal abnormalities were evident. Compared with white collar workers, the construction workers showed a 3.5 to 8.4 increased rate of disability (P<0.05) for all occupational groups.	Yes		Health examination	
Liira <i>et al.</i> , 1996	Work exposures and long term back problems	Cross-sectional population survey	Back	Long-term definition?	Prevalence of long-term back pain was 7.8%. This increased with age, those with less formal education, smokers, overweight, blue collar workers and those with lower income.	Yes		Questionnaire survey	
Stürmer <i>et al.</i> , 1997	Low back pain in various male construction jobs	Cross-sectional	Low back	Last 12 months	Prevalence of low back pain highest in painters (57%), intermediate in concrete builders and bricklayers (41%), and lowest in carpenters and unskilled workers (38%).	Yes			
Hughes <i>et al.</i> , 1997	Prevalence of MSD and their association with physical and psychosocial characteristics of jobs	Cross-sectional study in an aluminium smelter	Upper limb and back		Years of forearm twisting were found to be a significant predictor for upper limb disorders. Low decision latitude was a significant predictor for shoulder pain. High job satisfaction (OR=5.9, 95% CI=1.4-25) and low social support (OR = 5.3, 95% CI=1.3-22) were associated with low back pain.	Yes		Structured interview, physical exam and questionnaire	
Toomingas <i>et al.</i> , 1997	Associations between psychosocial factors and MSD	Cross-sectional study of 358 people	General MSD	Current	Low social support at work, high psychological demands and job strain were associated with MSD symptoms and signs. Decision latitude at work showed few associations with musculoskeletal disorders.	No		Self report questionnaire, medical examinations	Controlled for age, gender, physical load

Low status (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Polanyi <i>et al.</i> , 1997	Prevalence and associations of upper limb problems among newspaper personnel	Cross-sectional survey	Upper limb (ULDs)	20% reported moderate or worse ULDs monthly or lasting more than a week in last year.	Those facing frequent deadlines, high psychological demands (fast work pace, conflicting demands) had low skill discretion and social support, spent more time keyboarding, or had computer screen in non-optimal position were likely to report moderate to severe symptoms. Women reported significantly higher levels of symptoms than men.	Yes			
Feeney <i>et al.</i> , 1998	Socio-economic and sex differentials in reasons for sickness absence	Longitudinal analysis of 5620 civil servants in Whitehall II study	General MSD	Short (<7 days) and long (>7 days) absence	Headache and migraine, musculoskeletal disorders, injury and neurosis accounted for 20%-30% of absences. The lower the employment grade the higher the rate of absence for both short and long spells. In general women had higher rates of absence than men.	Yes		Questionnaires, physical exam, GP records, company records of sickness absence	
Woods <i>et al.</i> , 1999	Musculoskeletal health among cleaners	Cross-sectional	General MSD	Last 7 days and last 12 months	Higher than expected prevalence of musculoskeletal pain and discomfort (74% in last year, 53% in last week) was found among cleaners. The proportion of cleaners seeking medical advice was 52%. 23% reported taking time off work in last year.	Yes		Questionnaire, workplace assessments, laboratory trials, focus groups	
Baker <i>et al.</i> , 1999/2000	Background factors, work practises and psychosocial variables and musculoskeletal discomfort	Cross-sectional study of 155 customer service representatives	Last 12 months and last 7 days	Back and upper limb and neck	93% reported musculoskeletal discomfort in some body part. The amount of social support, job variety and skill utilisation in the job were the psychosocial variables most often associated with musculoskeletal discomfort (apart from the neck).	Yes		Self report questionnaires	
Thorbjörnsson <i>et al.</i> , 2000	Physical and psychosocial occupational factors related to low back pain	Longitudinal	Back	24 year follow-up	Factors at work were risk indicators for low back pain for both genders: low influence over work conditions, heavy physical workload, sedentary work, smoking among women and poor social relations at work, heavy physical workload, sedentary work, high perceived load outside work and combination of poor social relations and overtime among men, in combination with other factors.	Yes			

Income

Summary

- Income has a strong influence on health. It influences where people live, the type of house they live in, access to leisure, education, clothing and fuel (Lyon 1998).
- Research on income and general ill health, often linked to occupational class and low status jobs, indicates that income contributes to health problems.
- The majority of studies indicate that lower income levels are associated with an increase in musculoskeletal problems.

Income and general ill health

Many research studies have been conducted on income and health in the sociological literature. Four study examples have identified a link between low pay and perceived ill health among women (Ross and Bird, 1994), the negative effect of low pay on absenteeism (Brooke and Price, 1989), greater disability and lower family income in a follow-up study on an ageing cohort (Hubert *et al*, 1993) and a significant correlation between percentage of total household income and mortality in USA (Kaplan *et al*, 1996). Income inequality in this study was also significantly associated with other factors including work disability and sedentary activity.

Ross and Bird (*ibid*) raised an interesting argument that gender differences in labour and lifestyles explained differences in perceived health. Gender inequality in paid and unpaid work and subjective experiences of inequality disadvantage women. Women were less likely to be employed, more likely to be part-time, have low incomes and do more unpaid domestic labour than men. The study found all these factors, apart from domestic labour, were associated with ill health. Similar arguments concerning exposure to different psychological and job conditions are put forward by a number of researchers (Messing, 2000; Punnett and Herbert, 2000) in Section 2 to explore gender differences in musculoskeletal health.

Income and musculoskeletal ill health

Five studies included the factor 'low income' or 'perceived low income' in investigations on musculoskeletal ill health.

Three studies focussed on back pain. An early study (Leigh and Sheetz, 1989) did not find an association between prevalence of back pain and income. Two more recent studies of working populations identified associations between low income and prevalence of chronic back trouble (Liira *et al.*, 1996) and perceived inadequacy of income and low back pain (Papageorgiou *et al.*, 1997). The later study also found that perceived inadequacy of income along with social class were strongly associated with consulting with a new episode of low back pain during the last year.

Two further studies looked at musculoskeletal disability (Badley and Ibañez, 1994) and musculoskeletal disorders among older (aged 51-61 years) workers (Yelin, 1997) found that musculoskeletal ill health was independently associated with reported lower income.

Four out of the five reviewed studies found an association between lower income level and musculoskeletal ill health. However, there are only a limited number of studies in the literature that explored the associations between income and musculoskeletal ill health. The relationship between low income and workplace risk factors requires further elucidation.

Table 5: Summary of research studies on income and musculoskeletal ill health

Income	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD or disability	Coping and recovery disability, retirement etc	Reporting methods	Control for variables
Leigh and Sheetz, 1989	Prevalence of back pain in USA	Cross-sectional	Back	Last year	20% back trouble in previous year. Back pain prevalence was significantly associated with occupation group, low education level, smoking, and job conditions but not sex, race, tallness, obesity, age, marital status and income.	No		Self report	
Badley and Ibañez, 1994	Socio-economic risk factors and musculoskeletal disability in Canada	Cross-sectional	General MSD disability	Disability	Risk factors (apart from gender) associated with musculoskeletal disability similar to those for other cases of disability. Independently associated with increasing age, not being married, less years of schooling, lower income and unemployment.	Yes		Questionnaire survey	
Liira <i>et al.</i> , 1996	Work exposures e.g. vibration, postures) and long term back problems in Canada	Cross-sectional population survey	Low back	Long-term	Prevalence of long-term back pain was 7.8%. This increased with age, those with less formal education, smokers, overweight, blue collar workers and those with lower income. Only a slight difference in prevalence between men and women. Higher prevalence in two oldest age groups	Yes		Questionnaire survey	
Papageorgiou <i>et al.</i> , 1997	Work related psychosocial factors, social status and occurrence of new episodes of low back pain and consultation behaviour	Initial cross-sectional study and a prospective study over 1 year	Low back	Pain lasting more than 24 hrs in last 4 weeks; New episodes in 12 months	Initial survey indicated a modest but significant association between low back pain in last 4 weeks and perceived inadequacy of income (rr 1.3), dissatisfaction with work (rr 1.1) and social class (rr 1.2). Both perceived inadequacy of income (rr3.6) and lower social class (rr4.8) were strongly associated with consulting with a new episode of low back pain during the year.	Yes	Gender differences in reporting behaviour – women in lower social class more likely to report; perceived low income more strongly associated with men reporting.	Questionnaire	Risks adjusted for age; adjustment for social class did not alter relationship between income and consultation
Yelin, 1997	Earnings, income and assets of persons aged 51-61 with and without musculoskeletal conditions	Cross-sectional	General MSD	Current	Fifty-nine percent of persons 51-61 years of age reported one or more MSD conditions. Persons with musculoskeletal conditions and co-morbidity reported 18% lower family earnings, 15% lower family income and 35% fewer assets than the average among all persons of these ages. Persons with musculoskeletal conditions and no co-morbidity have earnings, income and assets closer to the average.	Yes		Data from a national, community based probability sample of persons	

Section 2 – Individual factors

Introduction

In this section the studies of the association between individual factors (i.e. age, gender and ethnicity) or 'fixed constitutional factors' (Dahlgren and Whitehead, 1991) will be reviewed. The profile of the workforce has changed in the last decade in most industrialised countries. The workforce is growing older, there are many more women in the workplace and the workforce is comprised of many different ethnic groups. These personal and individual factors are unchangeable and might be confounded by occupational demands and should be accommodated in the workplace to ensure worker health and safety (Punnett and Herbert 2000; Riihimaki, 1995). Level of education is also reviewed in this section as it is a characteristic that people bring to the workplace.

As will become apparent in the review, these individual factors appear to have an influence on the experience of musculoskeletal problems at work; however this is likely to be a result of their interaction with other factors in the workplace e.g. occupational type, job insecurity, work organisation culture, (factors reviewed in Section 1). Due to these individual factors (e.g. being an older worker or being female) certain groups of workers may be exposed to factors in the workplace that will lead to inequality in musculoskeletal health.

It is important to bear in mind that individual factors are often confounders in the studies that have been reviewed. For example, age is often assumed to be related to musculoskeletal disorders in epidemiological studies but the variable age is also highly correlated with years spent in work. Women are commonly in monotonous and repetitive jobs and this might help to explain the high prevalence of musculoskeletal problems in upper limbs among women. In addition some studies indicate that women are not at an increased risk for disorders but are more likely to report musculoskeletal problems than men or have more demanding activities at home which increase total workload over the day and reduce the opportunity of physical recovery after a working day. Thus there is frequently a confounding effect when individual variables are considered. Better study designs and analyses attempt to control for this.

Changes to work systems (e.g. changing physical working heights, providing alternative equipment designs, reorganising working schedules, changing working methods) can accommodate individual factors and so reduce the occurrence of musculoskeletal disorders. However care is needed when change is introduced as alterations in the work and work environment can also cause problems to the health and well being of workers. An ergonomic approach (e.g. consultation with users, work systems where problems are monitored and good reporting systems are available) should be adopted at the workplace to ensure that individuals do not experience problems at work that may result in a risk for musculoskeletal disability.

Education level

Summary

- In 1997, 16 per cent of men and 21 per cent of women of working age had no qualifications. There were also large differences between ethnic groups (ONS, 1998).
- Although the extent to which education has an independent effect on health status and the mechanisms by which it does so are not fully understood, it does appear to have an important influence on health.
- This influence may be seen as both potentiating (i.e. providing the trigger for healthier lifestyles and behaviour) and protective (providing access to employment opportunities and other chances that can protect individuals from disadvantage later in life) Acheson (1998).
- The limited numbers of studies on education level and musculoskeletal disorders have shown an association between low education and an increased likelihood of musculoskeletal problems.

Education level and general ill health

Cohort studies show that those with low levels of educational achievement have poor adult health (Montgomery and Schoon, 1997; Bynner and Parsons, 1997). Level of education may act as a marker for other influences such as socioeconomic status, occupational level or lifestyle (Marmot *et al.*, 1997). Education may have a direct influence on health related behaviour: children who do well in education tend to report healthier behaviour in adult life in relation to diet, smoking and exercise (Wadsworth, 1997).

Education level and musculoskeletal ill health

Five studies included the factor 'education level' in investigations on musculoskeletal ill health.

Three studies on prevalence of back pain found an association with low education level (Liira *et al.*, 1996; Tang *et al.*, 1995; Leigh and Sheetz, 1989). Liira *et al* (ibid) also found that low income and unemployment were associated with a high prevalence for chronic back trouble; these factors may also be related to lower levels of education.

Badley and Ibañez (1994) found musculoskeletal disability was independently associated with less years of schooling. Like the Liira *et al* (ibid) study, earning a lower income and not being employed were also associated with musculoskeletal ill health.

In a study investigating factors that influence return to work, Straaton *et al* (1995) found that higher education level was an important predictor of those who returned to work after a musculoskeletal problem.

The limited numbers of studies available have found associations between low education levels and musculoskeletal ill health. There is also some evidence to show that a higher education level may be important in the recovery and rehabilitation from a musculoskeletal problem. More research is required on the extent to which low education level might impact on musculoskeletal disorders. If this association is further confirmed through more research, techniques to compensate for a lack of education in (and away from) the workplace should be identified to ensure inequalities do not exist.

Table 6: Summary of research studies on education and musculoskeletal ill health

Education level	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting methods	Control for variables
Leigh and Sheetz, 1989	Prevalence of back pain among fulltime workers in USA	Cross-sectional	Back	Last year	20% back trouble in previous year. Back pain prevalence was significantly associated with occupation group, low education level, smoking, and job conditions but not sex, race, tallness, obesity, age, marital status and income.	Yes		Self report	
Badley and Ibañez, 1994	Socio-economic risk factors and musculoskeletal disability	Cross-sectional	General MSD disability	Disability	Risk factors (apart from gender) associated with musculoskeletal disability similar to those for other cases of disability. Independently associated with increasing age, not being married, less years of schooling, lower income and unemployment.	Yes		Questionnaire survey	
Tang <i>et al.</i> , 1995	Relationship between workload and MSD in China	Cross-sectional epidemiological	Low back	Current	51% low-back disorders and correlated with older age, standing, previous back injury, lower education level, sport activity, work intensity, working posture, satisfaction with tools, work conditions and house work. Heavy workload and non-neutral posture were the main factors.	Yes		Questionnaire and clinical exam	
Straaton <i>et al.</i> , 1995	Musculoskeletal disability and return to work in USA – demographic and socio-economic characteristics	Database analysis – segmentation modelling and logistic regression	General MSD disability	_____	71% of those with arthritis or MSD accepted for rehabilitation between 1987-91 returned to work	_____	Not receiving disability benefit and higher education levels were best predictors of return to work. Also being female, White, younger, and those with non-back disorders were also more likely to be rehabilitated.	Database of cases from rehabilitation service over a 4 year period	
Liira <i>et al.</i> , 1996	Work exposures and long term back problems	Cross-sectional population survey	Low back	Long-term	Prevalence of long-term back pain was 7.8%. This increased with age, those with less formal education, smokers, overweight, blue collar workers and those with lower income. Only a slight difference in prevalence between men and women. Higher prevalence in two oldest age groups	Yes		Questionnaire survey	

Age

Summary

- The average age of the working population is increasing and in conjunction with this there is a rapid and simultaneous change in work conditions and job structures (Lindstrom, 1988). In the coming decades, demographic, economic and social changes will result in an increased proportion of elderly persons in the workforce in most industrialised countries (de Zwart *et al.*, 1995). By the year 2010, about 20% of the population of the EU and other developed countries will be aged over 60 years (Rabbitt, 1997). The Health and Safety Executive (HSE) suggest that special attention should be paid to creating a good fit between work demands and individual resources and to integrate individuals currently considered over retirement age into the productive working population (Haigh and Haslegrave, 1992).
- Some studies show that young age groups may be at particular risk for musculoskeletal problems (e.g. in heavy physical work situations such as nursing or construction). Research indicates that schoolchildren have a high prevalence of back pain (Murphy and Buckle, 2001; Burton *et al.*, 1996). Thus new entrants to the workforce may already have a history of musculoskeletal disorders. Prior history is considered to be a good predictor of future episodes for low back pain (Troup *et al.*, 1987).
- The results of the studies looking at the relationship between age and ill health are varied. Although there are a number of limitations (e.g. age is often highly correlated with years spent in work), older age appears to be a risk factor for the development of musculoskeletal disorders. However, younger age groups appear to be at particular risk in some occupations.

Age and general ill health

The variable 'age' has been considered in many studies as a possible risk factor for the development of general health problems. The results of a number of example studies reviewed are mixed. The findings from four studies looking at health indicate that older age is a risk factor for or associated with ill health in police (Burke, 1989), burnout among air traffic controllers (Dell'Erba *et al.*, 1994), poor work ability of active employees (Illmarinen *et al.*, 1997) and longer spells of absence from work (Sharp and Watt, 1995).

In contrast, one study found that absence due to ill health was more common among younger and also unskilled workers (Krapac *et al.*, 1985). A further study indicated that there was no association between age and physical ill health among data entry workers (Ong and Phoon, 1987).

Age and musculoskeletal ill health

The *Age Diversity in Employment - Code of Practice* (DfEE, 1999) covers good practice in six aspects of the employment cycle. Each factor has been considered with respect to specific aspects of interest:

- Recruitment on the basis of skills and abilities needed to do the job
- Selection on merit by focusing on application form information about skills and abilities and on interview performance
- Promotion on the ability, or demonstrated potential, to do the job
- Encourage all employees to take advantage of relevant training opportunities
- Redundancy decisions based on objective, job related criteria to ensure the skills needed to help the business are retained
- Ensure that retirement schemes are fairly applied, taking individual and business needs into account

Many of the aspects highlighted identify *skills and abilities*. It is unclear how *abilities* might be interpreted in light of the relationship between age and musculoskeletal function. The relative importance of age with respect to musculoskeletal disorders needs to be clearly spelled out if discrimination is not to occur.

The findings from a number of studies on musculoskeletal health indicate that older age is a risk factor for or associated with the prevalence of musculoskeletal problems among nurses (Lert *et al.*, 1989), railway workers (Brulin *et al.*, 1985) and workers in various occupations (Leclerc *et al.*, 1999; Huhtanen *et al.*, 1997; Badley and Ibañez, 1994). Studies on back pain (Liira *et al.*, 1996; Tang *et al.*, 1995) and neck pain (Leclerc *et al.*, 1999) showed that prevalence of long-term back pain increased with age. In contrast, Ahlberg-Hulten *et al.* (1995) found that none of the non-work factors (age, number of children or habitual status) had a significant effect on MSD in female health care personnel.

In a review of the literature on physical workload and the ageing worker, de Zwart *et al.* (1995) recognised that a progressive decline in physical work capacity, characterised by diminished aerobic capacity and muscular capacity has consistently been reported in studies. However, inter-individual differences appear to be considerable. The question of whether there are systematic differences in physical work demands between younger and older workers within occupations has been answered vaguely. Conflicting results bring into discussion the role of the actual working method as one of the determinants of the physical workload. An age-related imbalance between physical workload and physical work capacity was suggested to result in a chronic overload, increasing the risk of long-term health effects such as musculoskeletal complaints and disorders. For many ageing workers in physically demanding occupations, extreme physical workloads, increasing the risk of disease or disablement, are still reported.

For several complaints a flattening (i.e. no further increase with after 60 years) or decrease in prevalence was observed in older groups in a number of studies (Bart *et al*, 1997; Andersson *et al*, 1993).

Three studies found that musculoskeletal ill health, injury and sickness absence were more common among younger workers (Chau *et al.*, 1995; Krapac *et al*, 1985; Ong *et al.*, 1991). Similarly, Skovron *et al* (1987) found that recent lower back pain was significantly associated with younger age in nurses in the USA. The important point was made that these results may reflect the early withdrawal of back pain sufferers from nursing or the transfer into a job category perceived to be less physically demanding, resulting in a higher prevalence of low back pain in younger respondents.

Increasing age shows a general increase in risk with respect to many musculoskeletal disorders. However, the relationship varies with the type of outcome measured (e.g. reporting of symptoms, sickness absence, disability). The implications of increased prevalence of these disorders arising from the changing demographics of the workforce (notably the ageing of the workforce) requires further clarification. This is of particular importance with respect to the new targets being set by the Health and Safety Commission.

Table 6: Summary of research studies on age and musculoskeletal ill health

Age	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD/ disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Bruin <i>et al.</i> , 1985	Prevalence of MSD in railway workers in Scandinavia	Cross-sectional	General MSD	In last 7 days	Sites of MSD varied between countries. Disorders increased with age, employment duration. Nationality, age and employment duration important factors in explaining MSD.	Older	Prevalence of occupational incapacity varied among body regions and nationality		
Krapac <i>et al.</i> , 1985	Spinal pain among various skilled railway workers	Cross-sectional	Back		Absence more frequent among unskilled and semiskilled workers and among young. Frequency of radiating pain decreased in proportion with degree of work qualification.	Young			
Skovron <i>et al.</i> , 1987	Low back pain and work organisation among nurses	Prospective epidemiological	Low back	Recent low back (BP) pain in last 6 months	Associations with occurrence of back pain: younger age, satisfaction with work colleagues, being a registered nurse 43% low back pain sometime in past; 28% reported episodes of more than 3 days; 20% reported at least 1 episode in last 6 months	Young	Move to less physically demanding job, early departure from workforce	Self report questionnaire	Controlled job category, small positive association between satisfaction with co-workers and previous BP remained
Lert <i>et al.</i> , 1989	Health of nurses in public hospitals	Longitudinal over 5.5 years	General MSD		Health problems mainly relate to age. Oldest (over 40) group worse for MSD and other health problems. Perception of working conditions stable with slight improvement. Perceived stress related to mental and psychological load had not decreased.	Older	Less turnover. Young nurses more likely to leave profession	Interview	
Ong <i>et al.</i> , 1991	Musculoskeletal disorders in VDU operators, clerical workers and teachers				Data entry workers higher prevalence than other groups, teachers had the lowest. No direct association with age but higher prevalence in working mothers aged 26-35 years. Malays and Indians reported higher prevalence of MSD than their Chinese counterparts. Job activities, duration of VDU work, social and psychological factors should be taken into account in the development of MSD.	Young		Questionnaire	

Age (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Andersson <i>et al.</i> , 1993	Geographical area, age, gender, social class and chronic pain	Cross-sectional epidemiological study	Neck, back, upper and lower limbs	Chronic pain greater than 3 months (55%) and 49% lasting 6 months	Prevalence of pain increased with age up to 50-59 then decreased. High prevalence of chronic pain in general even among young. Women more multiple pain locations and higher prevalence in certain areas. Prevalence higher in blue collar workers.	Older	13% with reduced functional capacity (mainly blue collar)	Self report questionnaire mail survey	
Badley and Ibañez, 1994	Socio-economic risk factors and musculoskeletal disability	Cross-sectional	General MSD disability	Disability	Risk factors associated with musculoskeletal disability similar to those for other cases of disability. Independently associated with increasing age, not being married, less years of schooling, lower income and unemployment.	Older		Questionnaire survey	
Ahlberg-Hulten <i>et al.</i> , 1995	Perception of social support, job strain and musculoskeletal pain in female health care personnel	Cross-sectional study – results based on two studies	Low back, neck and shoulders	In last month	None of the non-work factors (age, number of children or habitual status) had a significant effect on MSD. Psychological demands, authority over decisions, skill utilisation and support at work had a statistically significant effect on lower back symptoms while neck and shoulder symptoms were associated with social support at work. Multivariate logistic regression showed different associations: higher the strain, the more symptoms in the back. Neck and shoulder pain more associated with low social support at work/relational and emotional factors.	No		Questionnaire	
Tang <i>et al.</i> , 1995	Relationship between workload and MSD	Cross-sectional epidemiological	Low back	Current	51% low-back disorders and correlated with older age, standing, previous back injury, lower education level, sport activity, work intensity, working posture, satisfaction with tools, work conditions and house work. Heavy workload and non-neutral posture were the main factors.	Older		Questionnaire and clinical exam	
Chau <i>et al.</i> , 1995	Implications of ULD on occupational activities	Cross-sectional study	Hand	Current injuries	Excess work injuries among unskilled workers and younger workers. High frequency of injured had both work and domestic demanding activities.	Young			
De Zwart <i>et al.</i> , 1995	Physical workload and ageing workers	Literature review	General MSD	————	Progressive decline in physical work capacity with age. Inter-individual differences considerable. Identified research areas that need more clarification.	Older			
Liira <i>et al.</i> , 1996	Work exposures and long term back problems	Cross-sectional population survey	Low back	Long-term	Prevalence of long-term back pain was 7.8%. This increased with age, those with less formal education, smokers, overweight, blue collar workers and those with lower income.	Older		Questionnaire survey	

Age (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Bart <i>et al.</i> , 1997	MSD, age, gender and physical work	Cross-sectional	Back, neck, upper and lower extremities	Regular pain	MSD among workers in physically demanding jobs increase with age for both sexes. For several complaints, a flattening or decrease in prevalence was observed in older groups. Higher rate of women reporting for some complaints. High number of complaints among older females.	Older	Gender and age discussed in relation to reasons for increase in complaints: survivor population, additional work duties, more likely to report	Self report questionnaire as part of occupational health survey	Stratified sample
Huhtanen <i>et al.</i> , 1997	Perceived changes in stress (including physical) symptoms and relationship to changes in work in older workers	Longitudinal over 11 years	Upper and lower limbs	Current	Stress symptoms marked increase with age, especially aches and pains in upper and lower limbs. More symptoms evident the more work had changed. Women had a greater increase in symptoms.	Older	Significant increase in avoidance reactions 6% women and 7% men could no longer manage full time work; proportion of subjects on disability pensions/died during follow-up was highest for those in physically demanding work in 1981	Self report questionnaire	Analysed by gender, work profile and age
Leclerc <i>et al.</i> , 1999	Factors that predict incidence, recurrence and persistence of neck disorders among workers in different occupations	Longitudinal epidemiological study over 12 months	Neck	In last 6 months, more than 30 days, treatment, visit to health professional	Older age and being female were predictive factors for neck pain	Older		Self report questionnaire	

Gender

- The findings from studies in the general health literature are very mixed in relation to gender differences in health. Similar numbers of studies found that gender differences in health problems do or do not exist. Controlling for the interaction with other variables sometimes removes a gender difference (Sharp and Watt, 1995).
- The majority of studies that have investigated the association of gender with musculoskeletal symptoms indicate that women are more likely to develop a musculoskeletal problem than men. Some studies have acknowledged differences in job conditions, experience at work and home as possible reasons for gender differences.
- The reasons behind gender differences in health are not always explored and may be misleading. More research is required on whether musculoskeletal risk varies between men and women in jobs with the same occupational exposure (Punnett and Herbert, 2000).

Gender and general ill health

The variable 'gender' has been considered in a number of studies as a possible risk factor for the development of general health problems.

The findings from six health studies looking at lifestyles (Ross and Bird, 1994; Arber and Lahelma, 1993; Hall, 1990), shiftwork among steel plant workers (Oginska *et al.*, 1993), job demands (Roxburgh, 1996) and sickness absence (Feeney *et al.*, 1998) indicated that women had more health problems than men; however health was found to improve with age among women but not among men in one study (Oginska *et al.*, 1993).

A number of these studies have indicated that there are often differences in the basic daily experience of men and women and that the sources of stress, and consequently ill health, in women's lives are more diverse and diffuse than those experienced by men (Ross and Bird, 1994; Beerman and Nachreiner, 1992; Hall, 1990) e.g. different job types (piecework, part-time, low status), lifestyle, responsibilities at work and at home (Arber and Lahelma, 1993).

Five studies indicated no differences in health between men and women. These health studies focussed on shiftwork in police officers (Beerman and Nachreiner, 1992), sickness absence (Sharp and Watt, 1995), job conditions (Barnett and Brennan, 1995; Stansfeld *et al.*, 1995) and managerial style (Gardiner and Tiggemann, 1999). Sharp and Watt (1995) indicated that gender differences in absence were removed by standardisation of age and occupational status.

Gender and musculoskeletal ill health

The variable 'gender' has been considered in many studies as a possible risk factor for the development of musculoskeletal health problems. The majority of studies looking at gender and musculoskeletal health have shown that women are more likely to develop a musculoskeletal problem than men.

The findings from many studies looking at prevalence and risk factors for back pain (Burgmaier *et al.*, 1988; Harreby *et al.*, 1986), prevalence of and risk factors for neck and upper limb pain (Leclerc *et al.*, 1999; Feuerstein *et al.*, 1997; Polanyi *et al.*, 1997), prevalence of general musculoskeletal problems (Bart *et al.*, 1997; Feuerstein *et al.*, 1997; Augustson and Morken, 1996; Andersson *et al.*, 1993; Messing *et al.*, 1993; Gun, 1990), stress (Huuhtanen *et al.*, 1997) and sickness absence (Brage *et al.*, 1998; Feeney *et al.*, 1998; Leijon *et al.*, 1998) indicated that being female was a risk factor for musculoskeletal ill health.

However, job type and conditions (e.g. repetitive, low status work) are important to consider when looking at the role of musculoskeletal health and gender. Mergler *et al.* (1987) identified more musculoskeletal problems among women but found that when looking at men and women working in similar conditions, symptoms levels were close. Likewise, Nordander *et al.* (1999) acknowledged that gender differences in physical and psychosocial exposure in work accounts for the gender differences in health identified.

Four studies have found that risk factors in the same job effect women and men differently (Feuerstein *et al.*, 1997; Fredricksson *et al.*, 1999; Virokannas *et al.*, 1999; Thorbjörnsson *et al.*, 2000). A further study indicated that one factor influencing return to work after a musculoskeletal disorder was being female (Straaton *et al.*, 1995) and another indicated that being male was associated with injury occurrence in a sawmill (Punnett, 1994).

A recent review of the literature on gender and musculoskeletal disorders (Punnett and Herbert, 2000) identified many variations in results and gaps in the literature with respect to issues of reporting behaviour, different work exposures and non-work exposures. More research is required on whether musculoskeletal risk varies between men and women in jobs with the same occupational exposure, both physical and psychosocial. The authors concluded that the substantial body of research evidence identifying the risk associated with specific occupational workplace stressors should provide the focus for preventive strategies.

In general, the musculoskeletal literature shows that women are more likely to experience a musculoskeletal problem than men. However, some of these studies highlight differences without exploring further potential confounders. Some researchers have found that variation in, for example, job conditions (e.g. unskilled work, job type or responsibilities away from work), are important to consider when examining gender differences in musculoskeletal health.

Women in the workplace are often exposed to different musculoskeletal and psychological constraints, even when they share job titles with men. Job and task assignments may differ by sex, and gender-associated biological and social characteristics may interact with workplace constraints to modify the exposures or the effects of working conditions. Jobs preferentially assigned to women may have specific exposures that escape the attention of researchers (Messing, 2000). More research is required to investigate whether musculoskeletal ill health risk varies between women and men in jobs with the same occupational exposures and status.

Table 8: Summary of research studies on gender and musculoskeletal ill health

Gender	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting methods	Control for variables
Harreby <i>et al.</i> , 1986	Risk factors for low back pain in 38 year olds	25 year prospective cohort study of 640 school children	Low back (LBP)	Lifetime, 1 year and point prevalence	Cumulative lifetime prevalence of LBP = 70%, 1 year prevalence = 63%, point prevalence 19%, independent of gender. Women reported higher incidences of LBP. Heavy manual work associated with LBP and smoking was more common among unemployed and sick subjects.	Female		Questionnaire	
Mergler <i>et al.</i> , 1987	Health and sex-specific working conditions in poultry slaughterhouses	Cross-sectional	General MSD		More MSD among women related to ergonomic and organisation of job. Other health problems (e.g. auditory) were reported to a similar extent by men. Men and women's jobs differed. More women reported that the job involved standing still, repetitive movements, very rapid work rate and working with small instruments. Men reported more moving around, lifting heavy objects, working in alternative areas and use of large equipment. Symptom levels closer for men and women in similar working conditions.	Female		Self report questionnaire	Controlled for age and seniority as men were on average younger and less senior than women
Burgmaier <i>et al.</i> , 1988	Personal and occupational risk factors for backache in hospitals	Cross-sectional survey	Back		Confirmed previous research with respect to risk factors (age, sex, length of service, job content including heavy physical workload) and obesity and previous attacks of back pain.	Female	Consequences and prevention measures were discussed including importance of sport.	Self report questionnaire	
Gun, 1990	Incidence and distribution of RSI in Australia	Analysis of data from various surveys	Upper limb		High prevalence in blue collar workers. Higher prevalence among women in all occupational and industrial categories. Groups most at risk are female workers performing unskilled, unfulfilling tasks.	Female			
Andersson <i>et al.</i> , 1993	Geographical area, age, gender, social class and chronic pain	Cross-sectional epidemiological study	Neck, back, upper and lower limbs	Chronic pain greater than 3 months (55%) and 49% lasting 6 months	Prevalence of pain increased with age up to 50-59 then decreased. High prevalence of chronic pain in general even among young. Women more multiple pain locations and higher prevalence in certain areas. Prevalence higher in blue collar workers.	Female	13% reduced functional capacity (mainly blue collar)	Self report questionnaire mail survey	

Gender (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Messing <i>et al.</i> , 1993	Health effects of the sexual division of labour (task of toilet cleaning done exclusively by women) among 36 train cleaners	Cross-sectional	General	In last 5 years (using occupational health records)	Rigid sexual division of labour. Number of physical constraints: awkward posture, manual handling and fast pace. Women suffered more MSD and were more frequently absent (x 3 times) from work than men.	Female	Inability to rotate jobs may be associated with specific health and safety risks for both sexes	Interviews, observation, analysis of occupational health and company absence records	
Punnett, 1994	Risk factors for injury in a sawmill industry	Case control cross-sectional study	General MSD injury		Cases were more likely than controls to be employed in machine paced jobs, exposed to dangerous work methods and materials, experience louder noise levels and faster work pace, have higher lifting demands and more frequent postural stress, experience lower decision latitude and lower social support at work. Being male, being one year or less in the job, inability to take a break when tired were also significantly associated with injury occurrence.	Male	Decision latitude and social support had small protective effects.	Cases identified by a compensation commission. Interviews	
Straaton <i>et al.</i> , 1995	Musculoskeletal disability and return to work in USA – demographic and socio-economic characteristics	Database analysis – segmentation modelling and logistic regression	General MSD disability	—————	Not receiving disability benefit and higher education levels were best predictors of return to work after disability. Being female, White, younger, and those with non-back disorders were also more likely to be rehabilitated. 71% of those with arthritis or MSD accepted for rehabilitation between 1987-91 returned to work.	—————	Being female more likely to go back to work after disability	Database of cases from rehabilitation service over 4 years	
Augustson and Morken, 1996	MSD among dental health personnel	Cross-sectional	General		No difference in prevalence from general population. Females reported higher prevalence of MSD.	Female			
Polanyi <i>et al.</i> , 1997	Prevalence and associations of upper limb problems among newspaper personnel	Cross-sectional survey	Upper limb	20% reported moderate or worse ULDs monthly or lasting more than a week in last year.	Those facing frequent deadlines, high psychological demands (fast work pace, conflicting demands) had low skill discretion and social support, spent more time keyboarding, or had computer screen in non-optimal position were likely to report moderate to severe symptoms. Women reported significantly higher levels of symptoms than men.	Female			

Gender (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Feuerstein <i>et al.</i> , 1997	ULD in sign language interpreters	Cross-sectional	Upper limbs		74% neck pain and 70% hand/wrist pain. Female gender, number of years worked, pressure at work, fear of developing pain, tendency to work in pain to ensure work quality, and increased wrist deviations from neutral were associated with upper limb symptoms. Combination of work demands, work style and psychosocial stressors are associated with case status and exacerbation of pain, muscular tension functional limitations and work disability. Time off work was associated with tendency to work in pain to ensure work quality, fear of developing pain problems and lack of opportunity to use initiative	Female		Self report questionnaire	
Bart <i>et al.</i> , 1997	MSD, age, gender and physical work	Cross-sectional	Back, neck, upper and lower extremities	Regular pain	MSD among workers in physically demanding jobs increase with age for both sexes. For several complaints, a flattening or decrease in prevalence was observed in older groups. Higher rates of reporting by women for some complaints. High number of complaints among older females.	Female	Gender and age discussed in relation to reasons for increase in complaints e.g. survivor population, additional work duties, women more likely to report	Self report questionnaire, as part of occupational health survey	Stratified sample

Gender (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Feuerstein <i>et al.</i> , 1997	Prevalence of musculoskeletal-related disability, gender, and military occupational specialities in US Army personnel	Analysis of 41,750 disability cases	General	Any cases submitted over 4 years to the database - unfit for duty, temporarily or permanently retired	Back disorders represented most prevalent source of disability. Certain occupations specialities were associated with higher disability risk. Women experienced higher overall ($rr=1.3, 1.26-1.33$) and musculoskeletal ($rr= 1.22, 1.17-1.27$) disability risk. Specific jobs were identified in which women experienced higher rates of MSD. Majority (94%) of physical disability sample were under 45 years with largest group in 25-34 years. White people experienced more MSD than Black ($rr=1.18, 1.16-1.21$) personnel. Research indicates that MSD represent a prevalent source of outpatient visits, duty restrictions, lost work time, hospitalisation and disability.	Female	Women's psychosocial experiences in the army may be different to men.	Disability agency database	
Huhtanen <i>et al.</i> , 1997	Perceived changes in stress symptoms (including physical) and relationship to changes in work in older workers	Longitudinal over 11 years	Upper and lower limbs	Current	Stress symptoms showed marked increase with age, especially aches and pains in upper and lower limbs. More symptoms apparent the more work had changed. Women had greater increase in symptoms.	Female	Significant increase in avoidance reactions 6% women and 7% men could no longer work full time; proportion of subjects on disability pensions/died during follow-up highest for those in physically demanding work in 1981	Self report questionnaire	Analysed by gender, work profile and age
Feeney <i>et al.</i> , 1998	Socio-economic and sex differentials in reasons for sickness absence	Longitudinal analysis of 5620 civil servants in Whitehall II study	General MSD	Short (<7 days) and long (>7 days) absence	Headache and migraine, musculoskeletal disorders, injury and neurosis accounted for 20%-30% of absences. The lower the employment grade the higher the rate of absence for both short and long spells. In general women had higher rates of absence than men.	—		Questionnaires, physical exam, GP records, company records of sickness absence	

Gender (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Brage <i>et al.</i> , 1998	Gender differences in long-term sickness absence due to musculoskeletal health problems	Analysis of data from the National Sickness Benefit Register in Norway	General MSD	Sickness absence more than 14 days	Women had higher cumulative incidence of sickness absence and longer mean duration of episodes but episode frequency did not differ. Multivariate analysis indicated that the large gender differences in sickness absence might be overstated due to lack of adjustment for income and income-related factors.	Female	Long-term sickness absence was strongly associated with gender, age, income and diagnosis.		After adjustment in for age and gender reduced
Leijon <i>et al.</i> , 1998	Gender trends in sickness absence with musculoskeletal symptoms	Prospective population based study	General MSD	All new sick leave spells greater than 7 days over a 2 year period	More women than men sick-listed with musculoskeletal diagnoses except with the diagnosis "low back pain". Sick listing with musculoskeletal diagnoses increased for both women and men from 1985 to 1987, but the increase was consistently much higher for women, especially younger women.	Female			
Leclerc <i>et al.</i> , 1999	Factors that predict incidence, recurrence and persistence of neck disorders among workers in different occupations	Longitudinal epidemiological study over 12 months	Neck	In last 6 months, more than 30 days, treatment, visit to health care professional	Older age and being female were predictive factors of neck pain.	Female		Self report questionnaire	
Nordander <i>et al.</i> , 1999	Impact of work tasks, physical exposure and psychosocial factors on risk for MSD in men and women in fish processing work	Cross-sectional	General MSD	Last 12 months and last 7 days	Despite superficially similar work, clear sex differences in physical exposure and psychosocial work environment. Female workers had worse working conditions than men for repetitiveness, constrained neck postures and psychosocial work environment. High prevalence among women for neck, shoulders, elbow and hand.	Female	Women left the industry more often than men because of neck and upper limb problems	Questionnaire, physical examination, observation	
Fredricksson <i>et al.</i> , 1999	Association between risk factors for neck and upper limb disorders among blue collar workers	Longitudinal study	Neck and upper limb	24 year follow-up on; current condition	Risk factors differed between sexes. Among women, over-time work, high mental workload and unsatisfactory leisure time were associated with disorders in the neck-shoulder region. Among men, blue collar work and a simultaneous presence of high mental workload and additional domestic workload predicted disorders in the neck-shoulder region.	—			

Gender (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping, recovery disability, retirement	Reporting method	Control for variables
Virokannas <i>et al.</i> , 1999	Associations between long-term MSD and work career in older workers (>55 years)	Retrospective study	General MSD	Continuous sick leave for at least 1 month due to MSD was considered long term MSD	Long-term MSD reported by 62% of women and 57% of men. High prevalence associated with heavy physical work. In service work, majority were female; in industrial professions, the majority were male. Job mobility and declining work career (i.e. a decrease in work status) correlated with occurrence of long-term MSD in women; advanced work career connected with a low prevalence of long-term MSD. Job mobility was associated with prevalence of any type of long-term MSD among workers in heavy physical work.	Female	Type of work over a career can have an effect on the health of elderly workers	Postal self report questionnaire, interview and clinical exam	
Thorbjörnsson <i>et al.</i> , 2000	Physical and psychosocial occupational factors related to low back pain	Longitudinal	Low back	24 year follow-up	Factors at work were risk indicators for low back pain for both genders: low influence over work conditions, heavy physical workload, sedentary work, smoking among women and poor social relations at work, heavy physical workload, sedentary work, high perceived load outside work and combination of poor social relations and overtime among men, in combination with other factors.	No			
Messing, 2000	Occupational exposure differences in women and men	Literature review	General MSD	N/A	Women are often exposed to different musculoskeletal and psychological constraints, even when have same job titles as men. Job/tasks may differ by sex and gender associated biological and social characteristics may interact with workplace constraints to modify exposures. Jobs specifically assigned to women may have specific exposures.	—			
Punnett and Herbert, 2000	Gender differences in MSD	Literature review	General MSD	N/A	Comparison of MSD endpoints have shown no gender difference, especially for low back pain. Different occupational and non-occupational exposures for women. Men and women experience qualitatively and quantitatively different work conditions due to workplace sex segregation. More research required on whether MSD risk varies between men and women in jobs with same physical and psychosocial exposure.	No	Reporting behaviours appear to be different to men and women		

Ethnicity

Summary

- Ethnicity is difficult to define, but most definitions reflect self-identification with cultural traditions that provide both a meaningful social identity and boundaries between groups (Barot, 1996). In this summary of the research on health, ethnicity has various definitions and refers to cultural identity, place of origin as well as skin colour.
- A number of studies have considered the relationship between ethnicity and ill health. The studies indicate that differences exist in ill health conditions experienced by majority and minority groups giving some indication that health is not as good among minority groups. However Bhopal (1997) states that the similarities between minority and majority groups are greater than the differences.
- It is apparent from the studies that have investigated the association of ethnicity and musculoskeletal problems that the majority have indicated that musculoskeletal health differences exist between people from different ethnic backgrounds but the findings vary. A number of studies have concluded that the relationship between race, ethnic background and disease is mediated by several factors including genetic predisposition, socio-economic status and cultural patterns of belief and behaviour (Palinkas and Colcord, 1985).
- Abeysekera and Shahnavaz (1987) believe that ergonomics must take into account basic human factors differences such as size of people, organisations and cultural differences. Both Gurr *et al* (1998) and Bridger *et al* (1992) have stated that there needs to be a wider appreciation of the cultural specific nature of much ergonomic research. More research is required on whether musculoskeletal risk varies for ethnic groups living in the same country.

Ethnicity and general ill health

In the 1991 Census 5.5 per cent of the UK population identified themselves as belonging to one of the non-white minority ethnic groups. Almost half had been born in the United Kingdom (Owen, 1992). Recent estimates show that the Irish form the largest minority ethnic group, comprising 4.6 per cent of the population (Commission for Racial Equality, 1997).

Research studies have acknowledged that differences exist between minority and majority groups in the UK in relation to their geographical location (Owen, 1992, 1994), age and gender distribution (Owen, 1993), socioeconomic status (Office for National Statistics, 1998; Modood *et al.*, 1997), income (Modood *et al.*, 1997) and life style e.g. exercise and smoking habits (Health Education Authority, 1997).

The findings from a number of studies indicate that some ethnic groups are more likely to report their own health as poor (Nazroo, 1997), be less healthy (Crimmins *et al.*, 1999), consult doctors more (Nazroo, 1997), display lower

maximal heart rates than majority groups (Farrell *et al.*, 1988), show differences in pulmonary function (Chia *et al.*, 1993) and be at greater risk from job stress (Brett *et al.*, 1997) than the ethnic majority in the UK.

Difference in disease type among minority and majority groups has been acknowledged by a number of authors (McKeigue and Sevak, 1994; De Cock and Low, 1997; Nazroo, 1997; Wild and McKeigue, 1997; Owen, 1995). The diversity of experience of health between different ethnic groups may reflect different causes of poor health, differential susceptibility to these causes or differential access to factors which ameliorate cause or susceptibility e.g. preventive health care services (Acheson, 1998).

The most recent analysis of migrant mortality suggests that socioeconomic differences, as measured by social class, do not explain the different rates of mortality between groups born in different countries (Harding and Maxwell, 1997).

James (1994) reviewed studies looking at social identity, work stress and minority workers health. The review argued that social identity is a central issue to consider in studies of work stress in minorities. Social identity is proposed to exert a major influence both on behaviours directed toward minority workers by non-minority colleagues that can be stressors and on minority individuals own perceptions of stress and their ability to cope with it.

Ethnicity and musculoskeletal ill health

The variable 'ethnicity' has been considered in a number of studies as a possible risk factor for the development of musculoskeletal health problems. Some studies have concluded that the relationship between race, ethnic background and disease is mediated by several factors including genetic predisposition, socio-economic status and cultural patterns of belief and behaviour (Palinkas and Colcord, 1985; Meers, 1987).

Although one study found there was less injury at work among immigrant workers (Meers, 1987), four studies found greater levels of musculoskeletal disorders (MSD) among immigrant workers/those who had received their education in a different country (Ekberg *et al.*, 1994, 1995; Ong *et al.*, 1991; Kvarnstrom and Hallden, 1983). In the Ekberg *et al.* (1995) study it is interesting to note that as well as being an immigrant worker, other determinants for early symptoms were being female and conducting jobs involving repetitive movements and jobs demanding precision; these findings may say something about the type of low status work immigrants are likely to be involved in.

Musculoskeletal problems have been found to be more prevalent among White workers than among a number of ethnic minority groups in three studies (Gorsche *et al.*, 1998; Feuerstein *et al.*, 1997; Burchfiel *et al.*, 1992). In contrast, one study indicated that Black males displayed a significantly higher risk for MSD than Caucasian males in the US Navy (Palinkas and Colcord,

1985). A further study (Gorsche *et al.*, 1999) showed no relation between ethnicity and prevalence or incidence of carpal tunnel syndrome.

A number of studies have identified variations in musculoskeletal health among workers living in different countries (Brulin *et al.*, 1988; Shahnavaz *et al.*, 1991; Waluyo *et al.*, 1996; Shimaoka *et al.*, 1998; Ong *et al.* (1991).

The findings of studies in the general health literature indicate that differences exist in ill health conditions experienced by minority and majority ethnic groups and that there is some indication that health is not as good among minority groups. The majority of studies that have investigated the association of ethnicity and musculoskeletal problems have indicated variations in musculoskeletal health among people from different ethnic backgrounds but findings vary. In some studies, minority and immigrant workers had a higher prevalence of musculoskeletal ill health; in other studies majority ethnic groups had more musculoskeletal problems. Clearer definitions of ethnicity for epidemiological studies are needed; various studies reviewed used different definitions and future research studies need to control more closely for individual factors including ethnicity.

Table 9: Summary of research studies on ethnicity and musculoskeletal ill health

Ethnicity	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Kvarnstrom and Hallden, 1983	Risk factors for occupational cervicobrachial disorder (OCD) in Sweden	Comparative case control	Back		A large proportion of cases were immigrants/received education in a different country. Significant differences between perception of workload and work environment and a slightly significant difference for negative relations with supervisors were apparent in the cases.	Minority			
Palinkas and Colcord, 1985	Health risks and disease incidence in the US Navy.	Cross-sectional	General MSD		Black males displayed significantly higher risk for MSD than Caucasian males.	Minority			
Meers, 1987	Discrepancy in incidence of injuries in immigrant (Inuit and White) populations	Discussion paper	Back	_____	Less injury in immigrant (Inuit) workers than among other workers (predominantly transient white southern Canadians) doing the same job. Considered a result of a combination of factors relating to cultural influence, genetics and physical environment.	Majority		Clinical examination of workers with fewer injuries	
Bulin <i>et al.</i> , 1988	Prevalence of MSD in railway workers in Scandinavia	Cross-sectional	General MSD		Sites of MSD varied between countries. Disorders increased with age, employment duration. Nationality, age and employment duration important factors in explaining MSD.	_____	Prevalence of occupational incapacity varied among body regions and nationality	Questionnaire	
Ong <i>et al.</i> , 1991	Musculoskeletal disorders in VDU operators, clerical workers and teachers	Cross-sectional	General MSD		Data entry workers higher prevalence than other groups, teachers had the lowest. No direct association with age but higher prevalence in working mothers aged 26-35 years. Malays and Indians reported higher prevalence of MSD than their Chinese counterparts. Job activities, duration of VDU work, social and psychological factors should be taken into account in the development of MSD.	_____		Questionnaire	

Ethnicity (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Shahnavaz <i>et al.</i> , 1991	MSD, work and worker related factors occupational stress in China and Thailand	Case studies	General MSD		Poor working conditions and lack of injury prevention programmes lead to MSD. The problems were serious and similar in the two countries. China: low back pain most prevalent problem. Problem frequency varied between industries, tasks and individuals. Influence of working conditions, age, number of years employed and type of tasks	—	Findings support development of programmes for improving working conditions and preventing stresses.	Questionnaire survey	
Burchfiel <i>et al.</i> , 1992	Prevalence of back pain and joint problems in a manufacturing company	Longitudinal study of 5903 workers	General MSD	In last year, lasting more than 30 days	35% back pain and 19% joint problems among manufacturing workers. Back pain lasting more than 30 days in 5.3%; 19.3% for joints. Problems significantly higher in men and among White workers. After adjusting for age, race and occupation, differences between men and women diminished. Differences in race diminished when other variables were controlled. Self reported back pain and joint problems were found to vary most by age (for all MSD outcomes) and occupation (i.e. managers, technicians) and less by gender and race in this occupation.	Majority		Self report questionnaire during medical surveillance exams	After adjusting for age, race and occupation gender difference diminished Difference in race diminished when other variables were controlled.
Ekberg <i>et al.</i> , 1994	Risk factors for MSD in relation to physical, organisational and psychosocial aspects of work environment	Case control study	Neck and shoulder	Last 6 months	Odds ratios calculated to identify main individual risk factors: being female (11.4), being an immigrant worker (4.9) and being a smoker (3.7). Physical work: repetitive movement demanding precision (7.5), light lifting (13.6), uncomfortable sitting postures (3.6), rushed pace (3.5). Work role ambiguity (16.5), low quality work (2.6), demands on attention (3.8). Work organisation and psychosocial work conditions are as important for MSD as physical work conditions	Minority		Clinical examinations, questionnaires	

Ethnicity (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting method	Control for variables
Ekberg <i>et al.</i> , 1995	Risk factors (individual, ergonomic, organisational and psychosocial) for MSD problems.	Cross-sectional of nine hundred randomly drawn subjects of the working population in a semi-rural community in Sweden	Neck and shoulder	Last 6 months	43% neck and 32% shoulders – slighter higher than Nordic sample. Significant determinants for early symptoms were being female, being an immigrant worker and conducting jobs involving repetitive movements and jobs demanding precision. High work pace, low work content and work role ambiguity were significant organisational risk factors while lifestyle characteristics did not appear to be risk factors. Reasons discussed for high prevalence among female and immigrant workers e.g. different reporting, low status, repetitive work, longer stay in jobs.	Minority	The study recommended that special attention is paid to female and immigrant workers in preventative interventions	Self report questionnaire	
Waluyo <i>et al.</i> , 1996	Differences in ergonomics, health and satisfaction among assembly workers in Sweden and Indonesia	Cross-sectional	General MSD	Last 12 months, last 7 days	Many work culture differences between two countries in perception of work. High MSD prevalence in both groups; Sweden higher in the upper limbs and lower back and Indonesians had more lower extremities problems. Physical job demands were associated with MSD symptoms. Competence development was associated with increased satisfaction. Work tasks in Indonesia were physically heavier but less monotonous with lower productivity demands and the workers were more satisfied with their jobs	—————		Questionnaire, interviews and company documents	
Feuerstein <i>et al.</i> , 1997	Prevalence of musculoskeletal-related disability, gender, and military occupational specialities in US Army personnel	Analysis of 41, 750 disability cases	General	Any cases submitted over 4 years to the database - unfit for duty, temporarily or permanently retired	Back disorders represented most prevalent source of disability. Certain occupations specialities were associated with higher disability risk. Women experienced higher overall (rr=1.3, 1.26-1.33) and musculoskeletal (rr= 1.22, 1.17-1.27) disability risk. Specific jobs were identified in which women experienced higher rates of MSD. Majority (94%) of physical disability sample were under 45 years with largest group in 25-34 years. White people experienced more MSD than Black (rr=1.18, 1.16-1.21) personnel.	Majority	MSD represent a prevalent source of outpatient visits, duty restrictions, lost work time, hospitalisation and disability. Women's psychosocial experiences in the army may be different to men.	Disability agency database	

Ethnicity (cont.)	Focus	Study type	Problem e.g. back	Onset	Incidence of disorders	Association with MSD / disability	Coping and recovery disability, retirement etc	Reporting	Control for variables
Shimaoka <i>et al.</i> , 1998	Comparative study of physical load in Japanese & Swedish nursery teachers	Cross-sectional	General MSD	Current	Musculoskeletal problems higher in Japanese teachers, particularly those in charges of very young children. Physical workload not sufficient to explain differences.	—————		Observation, physiological measurement	
Gorsche <i>et al.</i> , 1998	Prevalence and incidence of trigger finger and hand tool use in a meat packing plant	Cross-sectional study and follow-up examinations of 665 workers	Hand and fingers	Current	Increased prevalence of TF (14% point prevalence). Hand tool use increased risk. Although a significant relationship was found between ethnicity and presence of trigger finger in prevalence data, this was not confirmed in incidence study.	Minority	High turnover may underestimate problems.	Interviewed and examined to determine the point prevalence	
Gorsche <i>et al.</i> , 1999	Prevalence and incidence of carpal tunnel syndrome (CTS) in a meat packing plant and explore relationship between ethnicity and CTS	Cross-sectional study and follow-up examinations	Wrist	Current	Prevalence and incidence of CTS were higher than in general population. No relation was found between ethnicity, age, body mass index and CTS for either prevalence or incidence.	NO	Used for preventative health planning in job design, lifestyle assessment & cultural development	Measurements interviewed	

DISCUSSION

The aim of this report was to provide an overview of the relationship between aspects of work, inequality and musculoskeletal disorders.

Limitations of the literature

Each area of the Dahlgren and Whitehead (1991) model is recognised as being of potential importance in defining and understanding the relationship between inequality and health in general.

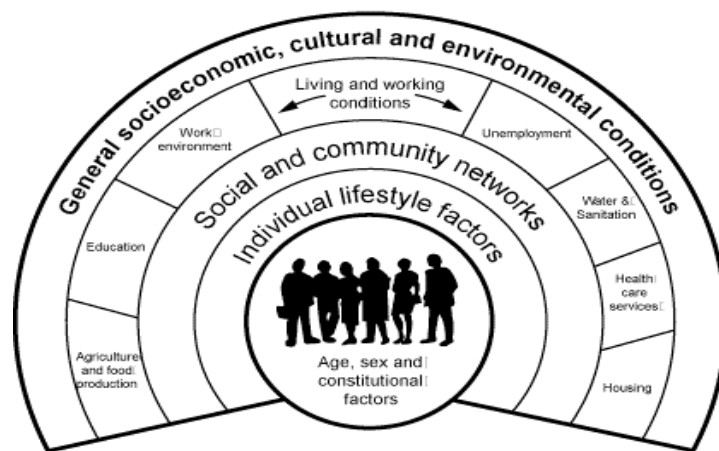


Figure 3
Socio-economic model of health and its inequalities
(Dahlgren & Whitehead, 1991)

This review has found that there is a paucity of evidence with respect to musculoskeletal health and its relationship with many of the areas shown in the model. For example, in considering living and working conditions, our review found that the relationship of musculoskeletal disorders to poor housing, access to health care services and unemployment has been investigated rarely.

Likewise, the interaction of the person with their social and community networks has received little attention (e.g. social support received away from work). This is surprising given that these factors may be important in determining how workers cope with problems or in their return to work after a musculoskeletal problem.

In the opinion of the reviewers, the limited research literature relating to these factors may have arisen for a number of reasons:

- a) Lack of a standardised model of inequality: in the same way that the Armstrong *et al* (1993) model for the development of musculoskeletal disorders guided research, a similar consensus model for inequality and musculoskeletal factors might now be required. The cognitive framework and systematic approach that such a model would afford to all researchers would be of immense benefit.
- b) Failure to define terms: terminology for many of the most critical factors (e.g. socio-economic, job insecurity, social support) appears to have little or no standardisation. The problems are exacerbated by cross-cultural and international differences. Thus the concepts used (and by implication the findings) in Northern European research may translate poorly to countries with weaker economies or substantially different cultures.
- c) Origin and setting of most epidemiological studies of musculoskeletal disorders: the emphasis in most studies has been on the relationship between physical workplace factors and the prevalence or incidence of the disorders. It is only comparatively recently that psychosocial factors have been studied widely and lack of definitions and the standardisation of terms remain significant problems.

The impact of these failings has been to limit both the scope and findings of the review. In addition the cross-sectional nature of many studies limits the possibility of determining causal relationships between work factors and musculoskeletal disorders. However cross-sectional studies based on large well defined and representative populations can give reliable estimates of prevalence rates and suggest risk factors worthy of testing in more rigorously designed studies (e.g. prospective designs).

Future research areas

Social support and musculoskeletal ill health

Many studies have investigated social support and its association with ill health. The studies vary significantly in their definitions of social support (e.g. amicability with co-workers, good relationship with supervisor, good social support at work) and it is impossible to know if these various definitions all have the same meaning.

The majority of studies indicated that a lack of social support whether from co-workers, supervisors or managers appears to be a risk factor for general and musculoskeletal ill health. When people have musculoskeletal problems at work or are returning to work after problems, social support seems to be important in their coping strategy.

Areas for further research

- Clear definitions are required for social support.
- The role of support received away from the work place should be investigated.
- How people use social support as a coping strategy for dealing with musculoskeletal disorders requires investigation.
- Ways of providing additional support at work and an evaluation of the benefits of such a provision should be studied.
- The extent to which good social support might impact on the recovery from musculoskeletal disorders should be established.

Access to health information at work and musculoskeletal ill health

The success of providing information that promotes healthy working practises either at work or in the community is an under researched area. However, there is support from the literature that provision of ergonomics and health and safety information is important.

Areas for further research

- Evaluation of different types of education programmes at work.
- Investigate ways in which health information (other than occupational health provision) is provided and managed and how successful this is in preventing ill health.
- More investigation into how inequality in access to information could effect exposure to known physical and psychological risk factors is required.
- Intervention studies are needed to investigate the usefulness of health information in encouraging people to report a musculoskeletal problem, helping them cope with these health problems and in the reduction of problems.

Job insecurity, temporary contract work, piece work and musculoskeletal ill health

Job insecurity has increased with changes in the labour market. As with job insecurity, temporary contracts at work are common. The findings of the studies that have investigated job insecurity, temporary, part time and piece work show that these job conditions have an effect on general and musculoskeletal ill health. However the number of studies on job insecurity and musculoskeletal health is limited.

Areas for further research

- Job insecurity is under researched with regard to musculoskeletal ill health. Current economic trends suggest that further research to establish its importance is now required.

- The relationship between reporting behaviour and job insecurity should be investigated.
- The extent to which these job conditions might impact on the recovery from musculoskeletal disorders might be researched.

Low status work and musculoskeletal ill health

Conditions typical of 'low-status' jobs were considered to be unskilled, paced, repetitive work, jobs where little/no training is required, low requirement to make decisions, low pay, and low control over the job. A sample of studies that investigated 'low status' jobs show an association with these job characteristics and ill health. All studies reviewed indicated that workers in jobs of lower status are at increased risk for the development of musculoskeletal disorders.

Areas for further research

- Standardised terms and definitions are required. These require validation and application in future epidemiological studies of musculoskeletal disorders.
- The extent to which low status work might impact on the recovery from musculoskeletal disorders should be established.

Income and musculoskeletal ill health

Research on income and ill health indicates that low income contributes to health problems. Similarly, the small number of studies investigating income and musculoskeletal health show that lower income levels are associated with an increased risk for musculoskeletal disorders.

Areas for further research

- The relationships between low income and exposure to known workplace risk factors requires elucidation.
- The extent to which low income might impact on the recovery from musculoskeletal disorders should be established.

Education level and musculoskeletal ill health

Cohort studies show that those with low levels of educational achievement have poor adult health (Bynner and Parsons, 1997; Montgomery and Schoon, 1997). Studies that have included low educational level as a factor for investigation have found associations with musculoskeletal ill health.

Areas for further research

- Research is needed to confirm this relationship. Studies should control for potential confounders (e.g. the relationship between low level of educational attainment and exposure to heavy physical work).

- If an association is confirmed through more research, techniques to compensate for a lack of education in (and away from) the workplace need to be identified to ensure inequalities do not exist.
- The relationship between low education level and recovery from musculoskeletal disorders should be explored.

Age and musculoskeletal ill health

The results of the studies looking at the relationship between age and ill health are not consistent. In general, older age appears to be a risk factor for the development of musculoskeletal disorders. However, younger age groups are at particular risk in some occupations. The changing demographics of the population make this factor an important one for research attention.

Areas for further research

- Consider the relationship between age and specific musculoskeletal conditions.
- Generate estimates of the likely impact of the changing demographic trends (notably increasing age of workforce) on musculoskeletal health.
- Better study designs are required that control for possible confounders in studies of age and musculoskeletal problems.

Gender and musculoskeletal ill health

In general, the musculoskeletal literature shows that women are more likely to experience a musculoskeletal problem than men. However, some of these studies highlight differences without exploring further potential confounders. Some researchers have found that variation in, for example, job conditions, job type or responsibilities away from work, account for gender differences in musculoskeletal health.

Areas for further research

- More research is required to investigate whether musculoskeletal ill health risk varies between women and men in jobs with the same occupational exposures and status.
- More research is needed on gender differences in musculoskeletal disorders outcomes and what mediates these from an inequality perspective.
- Studies of poor working conditions have generally focussed on women; subjects of both genders should be included in the study design to see whether differences exist.
- Research on the relationship between gender and the reporting of musculoskeletal problems is required. Some researchers have suggested that women are more likely to report health problems and an understanding of this gender difference might enable more early reporting of musculoskeletal ill

health. This would then allow for earlier, more effective interventions to be made.

Ethnicity and musculoskeletal ill health

The findings of studies in the general health literature indicate that differences exist in ill health conditions experienced by minority and majority ethnic groups. There is some indication that health is not as good among minority groups. The majority of studies that have investigated the association of ethnicity and musculoskeletal problems have found variations in musculoskeletal health among people from different ethnic backgrounds but findings vary. In some studies, minority and immigrant workers had a higher prevalence of musculoskeletal ill health; in other studies majority ethnic groups had more musculoskeletal problems. In making these comparisons the studies have generally failed to control for other known risk factors.

Areas for further research

- There have been no systematic studies of ethnicity and musculoskeletal health. More ergonomic research is required on the musculoskeletal health of different ethnic/cultural groups in the UK.
- Investigation of the musculoskeletal health of people from different cultural and ethnic backgrounds conducting the same work is essential to determine if there are work related determinants of inequality in musculoskeletal health.
- Clearer definitions of ethnicity for epidemiological studies are needed as the studies reviewed used different definitions.
- Future research studies need to control more closely for individual factors including ethnicity
- There is a need to investigate the cultural specificity of ergonomic research.

CONCLUSIONS

Few studies have attempted to generate data that would allow the aetiological contribution or risk associated with each factor to be ascertained. Thus it has not been possible to establish the extent to which factors might predict inequality in musculoskeletal health. Future researchers should be encouraged to quantify the risk attributable to those variables identified in this review.

The reporting of musculoskeletal health is, of necessity, limited by the reporting structures available. Therefore in countries with high occupational health coverage of the labour force, access to support services might encourage early reporting. Early intervention is often seen as important for influencing the natural history of the disorders. Thus inequality in the provision of such systems may impact on the patterns of reporting behaviour, the natural history and the return to work.

An overview of the relationship between aspects of work, inequality and musculoskeletal health has identified a number of factors of significance. Gaps in knowledge are evident and basic terms and definitions are missing. This along with the complex interrelationship and lack of independence of the variables has meant that attributing causal relationships is not possible. In view of the strength of many of the associations with both general health and musculoskeletal health, areas of future research have been advanced and prioritised.

REFERENCES

Abeysekera, JDA. and Shahnavaaz, H. 1987, Ergonomics of technology transfer, **International Journal of Industrial Ergonomics**, 1, 4, 265-272.

Acheson, D. 1998, **The Independent Inquiry into Inequalities in Health Report**. London: The Stationary Office.

Ahlberg-Hulten, GK., Theorell, T. and Sigala, F. 1995, Social support, job strain and musculoskeletal pain among female health care personnel, **Scandinavian Journal of Work Environment and Health**, December, 21, 6, 435-9.

Andersson, HI., Ejlertsson, G., Leden, I. and Rosenberg, C. 1993, To establish basic epidemiological data on chronic pain in a geographically defined general population: studies of differences in age, gender, social class, and pain localization, **Clinical Journal of Pain**, September, 9, 3, 174-82.

Arber, S. and Lahelma, E. 1993, Inequalities in women's and men's ill-health: Britain and Finland compared, **Social Science and Medicine**, October, 37, 8, 1055-68.

Armstrong, TJ., Buckle, PW., Fine, LJ., Hagberg, M., Jonsson, B., Kilbom, A., Kuorinka, I., Silverstein, BA., Sjogaard, G. and Viikari-Juntura, E. 1993, A conceptual model for work-related neck and upper-limb musculoskeletal disorders, **Scandinavian Journal of Work Environment and Health**, 19, 73-84.

Arndt, V., Rothenbacher, D. and Brenner, H. 1996, Older workers in the construction industry: results of a routine health examination and a five year follow up, **Occupational and Environmental Medicine**, 53, 10, Oct., 686-691.

Aston, J. and Lavery, J. 1993, The health of women in paid employment: effects of quality of work role, social support and cynicism on psychological and physical well-being, **Women and Health**, 20, 3, 1-25.

Augustson, TE. and Morken, T. 1996, Musculoskeletal problems among dental health personnel, a survey of the public health data health services in Hordaland, **Tidsskr Nor Laegeforen**, September 30, 116, 23, 2776-80.

Badley, EM. and Ibanez, D. 1994, Socioeconomic risk factors and musculoskeletal disability, **Journal of Rheumatology**, 21, 515-522.

Baker, NA., Jacobs, K. and Carifio, J. 1999/2000, The ability of background factors, workers practices and psychosocial variables to predict the severity of musculoskeletal discomfort, **Occupational Ergonomics**, 2, 1, 27-41.

Barnett, RC. and Brennan, RT. 1995, The relationship between job experiences and psychological distress: a structural equation approach, **Journal of Organizational Behavior**, 16, 3, 259-276.

Barot, R. 1996, **The Racism Problematic: Contemporary Sociological Debates on Race and Ethnicity**. Lewiston: The Edwin Mellen Press.

Bart, C., de Zwart, H., Broersen, JPJ., Frings-Dresen, MHW. and van Dijk, FJH. 1997, Musculoskeletal complaints in the Netherlands in relation to age, gender and physically demanding work, **International Archive of Occupational and Environmental Health**, 70, 352-360.

Beerman, B. and Nachreiner, F. 1992, Different effects of night and shiftwork for women and men, **Zeitschrift fur Arbeitswissenschaft**, 46, 4, 199-207.

Bhopal, R. 1997, Is research into ethnicity and health racist, unsound, or important science? **British Medical Journal**, 314, 1751-1756.

Black, D., Morris, JN., Smith, C. and Townsend, P. 1980, **Inequalities in Health – The Black Report**. Middlesex: Penguin.

Blaxter, M. 1997, Whose fault is it? People's own conceptions of the reasons for health inequalities, **Social Science and Medicine**, March, 44, 6, 747-56.

Bongers, PM., de Winter, CR., Kompier, MA. and Hildebrandt, VH. 1993, Psychosocial factors at work and musculoskeletal disease, **Scandinavian Journal of Work, Environment and Health**, 19, 297-312.

Brage, S., Nygård, JF. and Tellnes, G. 1998, The gender gap in musculoskeletal-related long-term sickness absence in Norway, **Scandinavian Journal of Social Medicine**, March, 26,1, 34-43.

Brett, KM., Strogat, DS. and Savitz, DA. 1997, Employment, job strain, and preterm delivery among women in North Carolina, **American Journal of Public Health**, 87, 2, 199-204.

Bridger, RS., Orkin, D., Henneberg, M. and Schierhout, G. 1992, Investigations of posture in first and third world settings, **Contemporary Ergonomics**, 161-166. Edited by E.J. Lovesey. Taylor & Francis, London.

Brooke, PP. and Price, JL. 1989, The determinants of employee absenteeism: an empirical test of a causal model, **Journal of Occupational Psychology**, 62, 1, 1-19.

Brulin, C., Jonsson, B. and Karlehagen, S. 1985, **Musculoskeletal Troubles in Railway Station Workers. A Descriptive Epidemiological Study**. National

Board of Occupational Safety and Health (Arbetarskyddsstyrelsen), Solna, Sweden, Arbete Och Halsas No. 1985:37.

Brulin, C., Jonsson, B., Jenssen, P.G., Karlehagen, S. and Romo, M. 1988, **Musculoskeletal Disorders among Railway Station Workers in Finland, Norway and Sweden**. National Board of Occupational Safety and Health (Arbetarskyddsstyrelsen), Solna, Sweden, Arbete och Halsas 1988:23.

Buckle, P. and Devereux, J. 1999, **Work Related Neck and Upper Limb Musculoskeletal Disorders**. Bilbao, Spain: European Agency for Safety and Health at Work.

Burchfiel, C.M., Boice, J.A., Stafford, B.A. and Bond, G.G. 1992, Prevalence of back pain and joint problems in a manufacturing company, **Journal of Occupational Medicine**, 34, 2, 129-134.

Burdorf, A., van-Riel, M. and Brand, T. 1997, Physical load as risk factor for musculoskeletal complaints among tank terminal workers, **American Industrial Hygiene Association Journal**, 58, 7, 489-497.

Burgmaier, A.C., Blindauer, B. and Hecht, M.T. 1988, Backache in hospitals: epidemiological aspects and role of various risk factors, **Revue d'Epidemiologie et Sante Publique**, 36, 1, 128-137.

Burke, R.J. 1989, Career stages, satisfaction, and well-being among police officers, **Psychological Reports**, 65, 1, 3-12.

Burton, A.K., Clark, R.D., McClune, T.D. and Tillotson, K.M. 1996, The natural history of low back pain in adolescents, **Spine**, 21, 2323-8.

Bussing, A. 1986, Worker responses to job insecurity: a quasi-experimental field investigation, **The Psychology of Work and Organization Current Trends and Issues**, Edited by G. Debus and H.W. Schroiff. North-Holland, Amsterdam, 137-144.

Bynner J. and Parsons S. 1997, **It Doesn't Get Any Better: The Impact of Poor Basic Skills on the Lives of 37 Year Olds**. London: The Basic Skills Agency.

Camerino, D., Molteni, G., Finotti, S., Capietti, M., Molinari, M., Cotroneo, L. and Morselli, G. 1999, Prevention of risk due to manual handling of patients: the psychosocial component, **Medicina del Lavoro**, March-April, 90, 2, 412-427.

Chau, N., Petry, D. and Gavillot, C. 1995, Occupational implications of serious upper limb injuries, **Archives des Maladies Professionnelles, de Medicine du Travail et de Securite Sociale**, 56, 112-22.

Chavalinitikul, C., Noptepkangwan, N. and Kanjanopas, F. 1995, Improvement of lifting heavy objects work, **Journal of Human Ergology**, 24, 1, 55-58.

Chia, SE., Wang, YT., Chan, OY. and Poh, SC. 1993, Pulmonary function in healthy Chinese, Malay and Indian adults in Singapore, **Annals of the Academy of Medicine – Singapore**, 22, 6, 878-884.

Chiang, HC., Ko, YC., Chen, SS., Yu, HS., Wu, TN. and Chang, PY. 1993, Prevalence of shoulder and upper-limb disorders among workers in the fish-processing industry, **Scandinavian Journal of Work, Environment and Health**, 19, 2, 126-131.

Commission for Racial Equality. 1997, **The Irish in Britain**. London: Commission for Racial Equality.

Crimmins, EM., Reynolds, SL. and Saito, Y. 1999, Trends in health and ability to work among the older working-age population, **Journal of Gerontology: Social Sciences**, 54B, 1, S31-S40.

Dahlgren, G. and Whitehead, M. 1991, **Policies and Strategies to Promote Social Equity in Health**. Stockholm: Institute of Futures Studies.

De Cock, K. and Low, N. 1997, HIV and AIDS, other sexually transmitted diseases, and tuberculosis in ethnic minorities in United Kingdom: is surveillance serving its purpose? **British Medical Journal**, 314, 1747-31.

Dell'Erba, G., Venturi, P., Rizzo, F., Porcu, S. and Pancheri, P. 1994, Burnout and health status in Italian air traffic controllers, **Aviation, Space and Environmental Medicine**, 65, 4, 315-322.

Department for Education and Employment. 1999, **Age Diversity in Employment - Code of Practice**. Nottingham: DfEE Publications.

De Witte, H. 1999, Job insecurity and psychological well-being: review of the literature and exploration of some unresolved issues. **Job Insecurity, A Special Issue of the European Journal of Work and Organizational Psychology**, 8, 2, June, 155-177.

De Zwart, BCH., Frings-Dresen, MHW., Van Dijk, FJH. 1995, Physical workload and the ageing worker: a review of the literature, **International Archives of Occupational and Environmental Health**, 68, 1, 1-12.

Dooley, D., Rook, K. and Catalano, R. 1987, Non-job stressors and their moderators, **Journal of Occupational Psychology**, 60, 2, 115-132.

Dyer, H. and Morris, A. 1990, **Human Aspects of Library Automation**. Hants: A. Gower.

Ekberg, K., Bjorkqvist, B., Malm, P., Bjerre-Kiely, B., Karlsson, M. and Axelson, O. 1994, Case-control study of risk factors for disease in the neck and shoulder area, **Occupational and Environmental Medicine**, 51, 262-266.

Ekberg, K., Karlsson, M., Axelson, O., Bjorkqvist, B., Bjerre-Kiely, B. and Malm, P. 1995, Cross-sectional study of risk factors for symptoms in the neck and shoulder area, **Ergonomics**, 38, 5, 971-980.

Engels, JA., van-der-Gulden, JWJ. and Senden, T. 1997, Prevention of musculoskeletal complaints in nursing: aims, approach and content of an ergonomic-educational programme, **Safety Science**, 27, 2/3, 141-148.

Farrell, SW., Kohl, HW., Rogers, T. and Knadler, GF. 1988, Cardiovascular fitness and maximal heart rate differences among three ethnic groups, **Research Quarterly for Exercise and Sport**, 59, 2, 99-102.

Faucett, J. and Rempel, D. 1994, VDT-related musculoskeletal symptoms: interactions between work posture and psychosocial work factors, **American Journal of Industrial Medicine**, November, 26, 5, 597-612.

Feeney, A., North, F., Head, J., Canner, R. and Marmot, M, 1998, Socioeconomic and sex differentials in reason for sickness absence from the Whitehall II Study, **Occupational and Environmental Medicine**, February, 55, 2, 91-8.

Ferrie, JE., Shipley, MJ., Marmot, MG., Stansfeld, S. and Smith, GD. 1995, Health effects of anticipation of job change and non-employment: longitudinal data from the Whitehall II study, **British Medical Journal**, November, 311(7015), 1264-9.

Feuerstein, M., Berkowitz, SM. and Peck, CA. 1997, Musculoskeletal-related disability in US army personnel: prevalence, gender, and military occupational specialties, **Journal of Occupational and Environmental Medicine**, January, 39,1, 68-78.

Feuerstein, M., Carosella, AM., Burrell, LM., Marshall, L. and DeCaro, J. 1997, Occupational upper extremity symptoms in sign language interpreters: prevalence and correlates of pain, function, and work disability, **Journal of Occupational Rehabilitation**, December, 7, 4, 187-205.

Fjellman Wiklund, A. and Sundelin, G. 1998, Musculoskeletal discomfort of music teachers: an eight-year perspective and psychosocial work factors, **International Journal of Occupational Environment Health**, April, 4, 2, 89-98.

Fox, J. and Benzeval, M. 1995, Perspectives on social variation in health, In **Tackling Inequalities in Health – An agenda for Action**. Eds M. Benzeval, K. Jude and M. Whitehead. London: Kings Fund.

Francois, M. 1991, Temporary work in industrial organizations. Effects on working conditions and work safety, **Travail Humain**, 54, 1, 21-41.

Fredriksson, K., Alfredsson, L., Köster, M., Thorbjörnsson, CB., Toomingas, A., Torgén, M. and Kilbom, A. 1999, Risk factors for neck and upper limb disorders: results from 24 years of follow up, **Occupational and Environmental Medicine**, January, 56,1, 59-66.

Gardiner, M. and Tiggemann, M. 1999, Gender differences in leadership style, job stress and mental health in male and female dominated industries, **Journal of Occupational and Organizational Psychology**, 72, 3, 301-315.

Grahn, B., Stigmar, K. and Ekdahl, C. 1999, Motivation for change in patients with prolonged musculoskeletal disorders: a qualitative two-year follow-up study, **Physiotherapy Research International**, 4, 3, 170-89.

Gorsche, RG., Wiley, JP., Renger, RF., Brant, RF., Gemer, TY. and Sastyiuk, TM. 1998, Prevalence and incidence of Stenosing Flexor Tenosynovitis (Trigger Finger) in a meat-packing plant, **Journal of Occupational and Environmental Medicine**, 40, 6, 556-560.

Gorsche, RG., Wiley, JP., Renger, RF., Brant, RF., Gemer, TY. and Sastyiuk, TM. 1999, Prevalence and incidence of Carpal Tunnel Syndrome in a meat packing plant, **Occupational and Environmental Medicine**, 56, 6, 417-422.

Gun, RT. 1990, The incidence and distribution of RSI in South Australia 1980-81 to 1986-87, **Medical Journal of Australia**, 153, 7, 376-379.

Gurr, K., Straker, L. and Moore, P. 1998, Cultural hazards in the transfer of ergonomics technology, **International Journal of Industrial Ergonomics**, 22, 4-5, 397-404.

Hagberg, M. 1988, Occupational musculoskeletal disorders - a new epidemiological challenge? In C. Hogstedt and C. Reuterwall (Eds), **Progress in Occupational Epidemiology**, pp15-26. Elsevier Science Publisher.

Hagberg, M. 1992, Exposure variables in ergonomic epidemiology, **American Journal of Industrial Medicine**, 21, 91-100.

Haigh, R. and Haslegrave, C. 1992, The older worker in industry, **Contemporary Ergonomics 1992**, pp181-185. E.J. Lovesey. (Ed). London: Taylor & Francis.

Haines, HM. and Wilson, JR. 1998, **Development of a Framework for Participatory Ergonomics**. HSE contract research report 174/1998. Suffolk: HSE Books. ISBN: 0717615731.

Hales, TR. and Bernard, BP. 1996, Epidemiology of work-related musculoskeletal disorders, **The Orthopedic Clinics of North America**, October, 27, 4, 679-709.

Hall, EM. 1990, **Women's Work: An Inquiry into the Health Effects of Invisible and Visible Labor**. National Institute for Psychosocial Factors and Health, Department of Stress Research, Karolinska Institute, Stockholm.

Harding, S. and Maxwell, R. 1997, Differences in the mortality of migrants. In: Drever, F. and Whitehead, M. (Eds) **Health Inequalities: Decennial Supplement: DS Series no.15**. London: The Stationery Office.

Harreby, M., Kjer, J., Hesselsoe, G. and Neergaard, K. 1986, Epidemiological aspects and risk factors for low back pain in 38-year-old men and women: a 25-year prospective cohort study of 640 school children, **European Spine Journal**, 5, 5, 312-8.

Health Education Authority. 1997, **Guidelines: Promoting Physical Activity With Black and Minority Ethnic Groups**. London: Health Education Authority.

Heaney, CA., Israel, BA. and House, JS. 1994, Chronic job insecurity among automobile workers: effects on job satisfaction and health, **Social Science and Medicine**, May, 38, 10, 1431-7.

Hibbard, JH. and Pope, CR. 1992, Women's employment, social support, and mortality, **Women and Health**, 18, 1, 119-33.

Hodgson, JT., Jones, JR., Elliott, RC. and Osman, J. 1993, **Self-Reported Work-Related Illness**. Suffolk: HSE Books. ISBN: 0717606074.

Hubert, HB., Bloch, DA. and Fries, JF. 1993, Risk factors for physical disability in an aging cohort: the NHANES I epidemiologic follow-up study, **Journal of Rheumatology**, March, 20, 3, 480-8.

Hughes, RE., Silverstein, BA. and Evanoff, BA. 1997, Risk factors for work-related musculoskeletal disorders in an aluminium smelter, **American Journal of Industrial Medicine**, July, 32, 1, 66-75.

Huhtanen, P., Nygard, CH., Tuomi, K. and Martikainen, R. 1997, Changes in stress symptoms and their relationship to changes at work in 1981-1992 among elderly workers in municipal occupations, **Scandinavian Journal of Work, Environment and Health**, 23, Suppl 1, 36-48.

Ilmarinen, J., Tuomi, K. and Klockars, M. 1997, Changes in the work ability of active employees over an 11-year period, **Scandinavian Journal of Work, Environment and Health**, 23, Suppl 1, 49-57.

James, K. 1994, Social identity, work stress, and minority workers' health. In: Keita, GP. and Hurrell, JJ. (Eds) **Job Stress in a Changing Workforce**. Washington DC: American Psychological Association, pp127-145.

Kaplan, GA., Pamuk, ER., Lynch, JW., Cohen, RD. and Balfour, JL. 1996, Inequality in income and mortality in the United States: analysis of mortality and potential pathways, **British Medical Journal**, April 20, 312(7037), 999-1003.

Kemmlert, K., Orelius-Dallner, M., Kilbom, A. and Gamberale, F. 1993, A three-year follow-up of 195 reported occupational over-exertion injuries, **Scandinavian Journal of Rehabilitation Medicine**, March, 25, 1, 16-24.

King, PM., Fisher, JC. and Gaeg, A. 1997, Evaluation of the impact of employee ergonomics training in industry, **Applied Ergonomics**, 28, 4, 249-256.

Kondo, Y., Hosokawa, M., Kajiyama, M., Hattori, M., Hirose, T. and Yamashita, N. 1989, A study on workload and musculoskeletal symptoms of female warehouse workers, **Journal of Science of Labour**, 65, 12, 636-650.

Krapac, L., Krmpotic, A., Pavicevic, L. and Domljan, Z. 1992, Cervicobrachial syndrome - work and disability, **Arhiv za Higijenu Rada i Toksikologiju**, 43, 3, 255-262.

Krapac, L., Jajic, I., Zele, L., Biocina, B. and Mihajlovic, D. 1985, Pain syndromes of the spine in the active population, **Arhiv za Higijenu Rada i Toksikologiju**, 36, 1-4, 343-354.

Krause, N., Lynch, J., Kaplan, GA., Cohen, RD., Goldberg, DE. and Salonen, JT. 1997, Predictors of disability retirement, **Scandinavian Journal of Work, Environment and Health**, December, 23, 6, 403-13.

Kvarnstrom, S. and Hallden, M. 1983, Occupational Cervicobrachial Disorder - a case control study, **Scandinavian Journal of Rehabilitation Medicine**, Supplement No. 8, 101-114.

Leclerc, A., Niedhammer, I., Landre, MF., Ozguler, A., Etoire, P. and Pietri Taleb, F. 1999, One-year predictive factors for various aspects of neck disorders, **Spine**, July, 24, 14, 1455-62.

Leigh, JP. and Sheetz, RM. 1989, Prevalence of back pain among fulltime United States workers, **British Journal of Industrial Medicine**, 46, 9, 651-657.

Leijon, M., Hensing, G. and Alexanderson, K. 1998, Gender trends in sickness absence with musculoskeletal symptoms in a Swedish county during a period of rapid increase in sickness absence, **Scandinavian Journal of Social Medicine**, September, 26, 3, 204-13.

Leino, P., Hasan, J. and Karppi, SL. 1988, Occupational class, physical workload, and musculoskeletal morbidity in the engineering industry, **British Journal of Industrial Medicine**, 45, 10, 672-681.

Leino, P. and Hanninen, V. 1995, Psychosocial factors at work in relation to back and limb disorders, **Scandinavian Journal of Work, Environment and Health**, 21, 2 134-142.

Lert, F., Logeay, P., Gueguen, A. and Marne, MJ. 1989, Professional development and health of nurses in public hospitals, **Travail Humain**, 52, 3, 213-230.

Liira, JP., Shannon, HS., Chambers, LW. and Haines, TA. 1996, Long-term back problems and physical work exposures in the 1990 Ontario Health Survey, **American Journal of Public Health**, 86, 3, 382-387.

Lindstrom, K. 1988, Age related differences in job characteristics and in their relationship to job satisfaction, **Scandinavian Journal of Work Environment and Health**, 14, 1, 24-26.

Linton, SJ. 1990, Risk factors for neck and back pain in a working population in Sweden, **Work and Stress**, 4, 1, 41-49.

Linton, SJ. and Kamwendo, K. 1989, Risk factors in the psychosocial work environment for neck and shoulder pain in secretaries, **Journal of Occupational Medicine**, 31, 7, 609-613.

Lund, T. and Borg, V. 1999, Work environment and self-rated health as predictors of remaining in work 5 years later among Danish employees 35-59 years of age, **Experimental Aging Research**, October, 25, 4, 429-34.

Lundberg, O. 1991, Causal explanations for class inequality in health - an empirical analysis, **Social Science and Medicine**, 32, 4, 385-93.

Lundberg, U. 1999, Stress responses in low-status jobs and their relation to health risks: musculoskeletal disorders, **Annals of the New York Academy of Sciences**, 896, 383-5.

Lyon, A. 1998, Material circumstances: possibilities for local action, In I. Sharp (Ed) **Social Inequalities on Coronary Heart Disease – Opportunities for Action**. London: The Stationary Office, pp.

Marcotte, AJ. 1991, Implementing a successful ergonomics program using in-house expertise: results through training, **Designing for Everyone**, Proceedings of the Eleventh Congress of the International Ergonomics Association, Paris. Eds. Y. Queinnec and F. Daniellou. London: Taylor and Francis, pp1777-1778.

Marcus, M. and Gerr, F. 1996, Upper extremity musculoskeletal symptoms among female office workers with video display terminal use and occupational psychosocial stressors, **American Journal of Industrial Medicine**, February, 29, 2, 161-70.

Marmot, MG., Smith, GD., Stansfeld, S., Patel, C., North, F., Head, J., White, I., Brunner, E. and Feeney, A. 1991, Health inequalities among British civil servants: the Whitehall II study, **Lancet**, June 8, 337(8754), 1387-93.

Marmot, MG., Bosma, H., Hemingway, H., Brunner, E. and Stansfeld, S. 1997, Contribution of job control and other risk factors to social variations in coronary heart disease incidence, **Lancet**, July 26, 350(9073), 235-9.

McKeigue, P. and Sevak L. 1994, **Coronary Heart Disease in South Asian Communities**. London: Health Education Authority.

Meers, CL. 1987, Discussion paper on the apparent discrepancy in incidence of occupational lumbar spine injury in the Inuit and White populations, **Proceedings of the 20th Annual Conference of the Human Factors Association of Canada**, Montreal, Quebec, October 14-17, 1, 171-174.

Mergler, D., Brabant, C., Vezina, N. and Messing, K. 1987, The weaker sex? Men in women's working conditions report similar health symptoms, **Journal of Occupational Medicine**, 29, 5, 417-421.

Messing, K. 2000, Ergonomic studies provide information about occupational exposure differences between women and men, **Journal of American Medical Women's Association**, Spring, 55, 2, 72-5.

Messing, K., Doniol-Shaw, G. and Haentjens, C. 1993, Sugar and spice and everything nice: health effects of the sexual division of labor among train cleaners, **International Journal of Health Services**, 23, 1, 133-46.

Modood, T., Berthoud, R. and Lakey, J. 1997, **Ethnic Minorities in Britain: Diversity and Disadvantage**. London: Policy Studies Institute.

Montgomery, S. and Schoon, I. 1997, Health and health behaviour, In J Bynner, E Ferri, P Shepherd (Eds) **Twentysomething in the 1990s: Getting On, Getting By, Getting Nowhere**. Aldershot: Ashgate.

Morrison, DL. and Roberts, OU. 1987, Job design and levels of physical and mental strain among prison officers, **Rising to New Heights with Technology**, Proceedings of the Human Factors Society 31st Annual Meeting, New York City, October 19-23, Volume 1, 340-344.

Moure-Eraso, R., Wilcox, M., Punnett, L., MacDonald, L. and Levenstein, C. 1997, Back to the future: sweatshop conditions on the Mexico-U.S. border. Occupational health impact of maquiladora industrial activity, **American Journal of Industrial Medicine**, May, 31, 5, 587-99.

Murphy, LR. 1991, Psychological distress in relation to employee age and job tenure, **Visions**, Proceedings of the Human Factors Society 35th Annual Meeting, San Francisco, California, September 2-6, Volume 1, 185-187.

Murphy, S. and Buckle, P. 2001, Low back pain amongst school children and physical risk factors in schools, **Proceedings Premus 2001**, Fourth International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders, p208.

Nadeau, D., Vezina, M., Vinet, A. and Brisson, C. 1990, Piecework and mental health alterations among female sewing machine operators, **Archives des Maladies Professionnelles de Medicine du Travail et de Securite Sociale**, 51, 7, 479-487.

National Academy of Science. 2001, **Musculoskeletal disorders and the workplace: low back and upper extremities**. National Academy Press.

National Institute of Occupational Safety and Health. 1997, **Musculoskeletal Disorders and Workplace Factors: a Critical Review of Epidemiological Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity and Low Back**. Ed. BP Bernard. Cincinnati, OH: NIOSH.

Nazroo, J. 1997, **The Health of Britain's Ethnic Minorities: Findings From a National Survey**. London: Policy Studies Institute.

Neale, AV. 1991, Work stress in emergency medical technicians, **Journal of Occupational Medicine**, 33, 9, 991-997.

Niemcryk, S.J., Jenkins, CD., Rose, RM. and Hurst, MW. 1987, The prospective impact of psychosocial variables on rates of illness and injury in professional employees, **Journal of Occupational Medicine**, 29, 8, 645-652.

Nordander, C., Ohlsson K., Balogh I., Rylander L., Pálsson, B. and Skerfving, S. 1999, Fish processing work: the impact of two sex dependent exposure profiles on musculoskeletal health, **Occupational and Environmental Medicine**, April, 56, 4, 256-64.

Occupational Health Advisory Committee. 2000, **Report and Recommendations on Improving Access to Occupational Health Support**. Health and Safety Commission.

Office for National Statistics. 1998, **Economic Trends no. 533**. London: The Stationery Office.

Office for National Statistics. 1995, **Labour Force Survey**. London: The Stationery Office.

Oginska, H., Pokorski, J. and Oginski, A. 1993, Gender, ageing, and shiftwork tolerance, **Ergonomics**, 36, 1-3, 161-168.

Ong, CN., Jeyaratnam, J. and Kee, WC. 1991, Technological change and work related musculoskeletal disorders: a study of VDU operators. In: Kumashiro, M. and Megaw, ED. (Eds) **Towards Human Work: Solutions to Problems in Occupational Health and Safety**. London: Taylor & Francis, 333-339.

Ong, CN. and Phoon, WO. 1987, Influence of age on performance and health of VDU workers, **Work with Display Units 86**, B. Knave and PG. Wideback (Eds). North-Holland: Amsterdam, pp211-215.

Owen, D. 1992, **Ethnic Minorities in Great Britain: Settlement Patterns, National Ethnic Minority Data Archive 1991 - Census Statistical Paper no.1**. Warwick: University of Warwick, Centre for Research in Ethnic Relations.

Owen, D. 1993, **Ethnic Minorities in Great Britain: Age and Gender Structure, National Ethnic Minority Data Archive 1991 - Census Statistical Paper no.2**. Warwick: University of Warwick, Centre for Research in Ethnic Relations.

Owen, D. 1994, Spatial variations in ethnic minority groups populations in Great Britain, **Population Trends**, 78, 23-33.

Owen, D. 1995, **Irish-Born People in Great Britain: Settlement Patterns and Socio-Economic Circumstances - Census Statistical Paper no.9**. Warwick: University of Warwick, Centre for Research in Ethnic Relations.

Palinkas, LA. and Colcord, CL. 1985, Health risks among enlisted males in the US Navy: race and ethnicity as correlates of disease incidence, **Social Science and Medicine**, 20, 11, 1129-41.

Papageorgiou, AC., Macfarlane, GJ., Thomas, E., Croft, PR., Jayson, MIV. and Silman, AJ. 1997, Psychosocial factors in the workplace - do they predict new episodes of low back pain? Evidence from the South Manchester back pain study, **Spine**, 22, 10, 1137-1142.

Pickett, CWL. and Lees, REM. 1991, A cross-sectional study of health complaints among 79 data entry operators using video display terminals, **Journal of the Society of Occupational Medicine**, 41, 3, 113-116.

Polanyi, MF., Cole, DC., Beaton, DE., Chung, J., Wells, R., Abdoell, M., Beech Hawley, L., Ferrier, SE., Mondloch, MV., Shields, SA., Smith, JM. and Shannon, HS. 1997, Upper limb work-related musculoskeletal disorders among newspaper employees: cross-sectional survey results, **American Journal of Industrial Medicine**, December, 32, 6, 620-8.

Punnett, L. 1994, **Case-Control Study of Sawmill Injuries in Maine**. Lowell, Massachusetts: Department of Work Environment, University of Lowell.

Punnett, L, and Herbert, R. 2000, Work-related musculoskeletal disorders: is there a gender differential, and if so, what does it mean? In: MB Goldman, M Hatch (Eds) **Women and Health**. San Diego, CA: Academic Press.

Putz-Anderson, V. 1988, The impact of automation on musculoskeletal disorders, **Ergonomics of Hybrid Automated Systems I**, W. Karwowski, HR. Parsaei and MR. Wilhelm (Eds). Amsterdam: Elsevier, pp645-651.

Rabbitt, P. 1997, Ageing and human skill: a 40th anniversary, **Ergonomics**, October, 40, 10, 962-981.

Rees, DW. and Cooper, CL. 1992, The occupational stress indicator locus of control scale: should this be regarded as a state rather than trait measure? **Work and Stress**, 6, 1, 45-48.

Riihimäki, H. 1995, Back and limb disorders. In JC. McDonald (Ed) **Epidemiology of Work Related Diseases**. London: BMJ Publishing, pp 207-238.

Robinson, SE., Roth, SL., Keim, J., Levenson, M., Flentje JR. and Bashor, K. 1991, Nurse burnout: work related and demographic factors as culprits, **Research in Nursing and Health**, June, 14, 3, 223-8.

Ross, CE. and Bird CE. 1994, Sex stratification and health lifestyle: consequences for men's and women's perceived health, **Journal of Health and Social Behavior**, June, 35, 2, 161-78.

Roxburgh, S. 1996, Gender differences in work and well-being: effects of exposure and vulnerability, **Journal of Health and Social Behavior**, September, 37, 3, 265-77.

Seitsamo, J., Riihimaki, H. and Tuomi, K. 1994, Predictors of sciatica in a four-year follow-up among elderly municipal employees, **Proceedings of the 9th International Symposium on Epidemiology in Occupational Health**, September 23-25, Cincinnati, Ohio.

Shahnavaz, H. 1987, Injuries in the developing countries, **Ergonomics**, 30, 2, 397-404.

Shahnavaz, H., Bao, S. and Chavalitsakulchai, P. 1991, Occupational stress at the workplace in industrially developing countries: case studies in China and Thailand. In: Kumashiro, M. and Megaw, ED. (Eds) **Towards Human Work: Solutions to Problems in Occupational Health and Safety**. London: Taylor & Francis, pp99-107.

Sharp, C. and Watt, S. 1995, A study of absence rates in male and female employees working in occupations of equal status, **Occupational Medicine**, 45, 3, 131-136.

Sheffield, D., Dobbie, D. and Carroll, D. 1994, Stress, social support, and psychological and physical wellbeing in secondary school teachers, **Work and Stress**, 8, 3, 235-243.

Shimaoka, M., Hiruta, S., Ono, Y., Nonaka, H., Wigaeus, S., Hjelbm, E. and Hagberg, M. 1998, A comparative study of physical work load in Japanese and Swedish nursery school teachers, **European Journal of Applied Physiology and Occupational Physiology**, 77, 1-2, 10-18.

Silverstein, BA., Richards, SE., Alcsar, K. and Schurman, S. 1991, Evaluation of in-plant ergonomics training, **International Journal of Industrial Ergonomics**, 8, 2, 179-193.

Skov, T., Borg, V. and Orhede, E. 1996, Psychosocial and physical risk factors for musculoskeletal disorders of the neck, shoulders and lower back in sales people, **Occupational and Environmental Medicine**, 53, 351-356.

Skovron, ML., Mulvihill, MN., Sterling, RC., Nordin, M., Touglas, G., Gallaher, M. and Speedling, EJ. 1987, Work organization and low back pain in nursing personnel, **Ergonomics**, 30, 2, 359-366.

Smith, MJ. 1997, Psychosocial aspects of working with video display terminals (VDTs) and employee physical and mental health, **Ergonomics**, October, 40, 10, 1002-15.

Stansfeld, SA., North, FM., White, I. and Marmot, MG. 1995, Work characteristics and psychiatric disorders in civil servants in London, **Journal of Epidemiology and Community Health**, February, 49, 1, 48-53.

Stansfeld, SA., Fuhrer, R., Head, J., Ferrie, J. and Shipley, M. 1997, Work and psychiatric disorders in the Whitehall II Study, **Journal of Psychosomatic Research**, July, 43, 1, 73-81.

Steenland, K., Johnson, J. and Nowlin, S. 1997, A follow-up study of job strain and heart disease among males in the NHANES1 population, **American Journal of Industrial Medicine**, February, 31, 2, 256-60.

Straaton, KV., Maisiak, R., Wrigley, JM. and Fine, PR. 1995, Musculoskeletal disability, employment, and rehabilitation, **Journal of Rheumatology**, March, 22, 3, 505-13.

Stürmer, T., Luessenhoop, S., Neth, A., Soyka, M., Karmaus, W., Toussaint, R., Liebs, TR. and Rehder, U. 1997, Construction work and low back disorder. Preliminary findings of the Hamburg construction worker study, **Spine**, Nov 1, 22(21): 2558-63.

Symonds, TL., Burton, AK., Tillotson, KM. and Main, CJ. 1995, Absence resulting from low back trouble can be reduced by psychosocial intervention at the work place, **Spine**, 20, 24, 2738-45.

Tang, CB., Cai, RT., Yang, L., Zhang, GG., Li, Y., Lu, QF., Laurig, W. and Angerman, K. 1995, An epidemiological study on the relationship between musculoskeletal disorders and work load, **Journal of Tongji Medical University**, 15, 1, 59-64.

Thomas, B. 1997, Management strategies to tackle stress in mental health nursing, **Mental Health Care**, September, 1, 1, 15-7.

Thorbjörnsson, CB., Alfredsson, L., Fredriksson K., Michélsen, H., Punnett, L., VingÅrd, E., Torgén, M. and Kilbom, A. 2000, Physical and psychosocial factors related to low back pain during a 24-year period. A nested case-control analysis, **Spine**, February, 25, 3, 369-75.

Toomingas, A., Theorell T., Michélsen H. and Nordemar, R. 1997, Associations between self-rated psychosocial work conditions and musculoskeletal symptoms and signs. Stockholm MUSIC I Study Group, **Scandinavian Journal of Work, Environment and Health**, April, 23, 2, 130-9.

Torp, S., Riise, T. and Moen, BE. 1999, How the psychosocial work environment of motor vehicle mechanics may influence coping with musculoskeletal symptoms, **Work and Stress**, 13, 3, July-September, 193-203.

Triolo, PK. 1989, Occupational health hazards of hospital staff nurses. Part I: overview and psychosocial stressors, **American Association of Occupational Health Nurses Journal**, 37, 6, 232-237.

Troup, JDG., Foreman, TK., Baxter, CE. and Brown, D, 1987, The perception of back pain and the role of psychophysical tests of lifting capacity, **Spine**, 12, 645-57.

Vachon, ML. 1995, Staff stress in hospice/palliative care: a review, **Palliative Medicine**, April, 9, 2, 91-122.

Vasseljen, O., Westgaard, RH. and Larsen, S. 1995, A case-control study of psychological and psychosocial risk factors for shoulder and neck pain at the workplace, **International Archives of Occupational and Environmental Health**, 66, 6, 375-382.

Verbeek, JH., Hulshof, CT., van Dijk, FJ. and Kroon, PJ. 1993, Evaluation of an occupational health care programme: negative results, positive results or a failure? **Occupational Medicine (Oxford)**, 43, Suppl 1, S34-7.

Vezina, M., Vinet, A. and Brisson, C. 1989, Premature ageing and piecework among female garment workers, **Travail Humain**, 52, 3, 203-212.

Vinet, A., Vezina, M. and Gingras, S. 1989, Effect of duration of employment in piecework on severe disability among female garment workers, **Scandinavian Journal of Work, Environment and Health**, 15, 2, 329-334.

Virokannas, H., Rahkonen, M., Luoma, I., Rajala U. and Uusimäki, A. 1999, Long-term musculoskeletal disorders and work career in 55-year-old workers, **Experimental Aging Research**, October, 25, 4, 301-6.

Wadsworth, M. 1997, Changing social factors and their long-term implications for health, **British Medical Bulletin**, 53, 198-209.

Walters, V., Lenton, R., French, S., Eyles, J., Mayr, J. and Newbold, B. 1996, Paid work, unpaid work and social support: a study of the health of male and female nurses, **Social Science and Medicine**, December, 43, 11, 1627-36.

Waluyo, L., Ekberg, K. and Eklund, J. 1996, Assembly work in Indonesia and in Sweden - ergonomics, health and satisfaction, **Ergonomics**, 39, 2, 199-212.

Warr, P. 1994, A conceptual framework for the study of work and mental health, **Work and Stress**, 8, 2, 84-97.

Wild, S. and McKeigue, P. 1997, Cross-sectional analysis of mortality by country of birth in England and Wales, 1970-92, **British Medical Journal**, 314, 705-710.

Woods, V., Buckle, P. and Haisman, M. 1999, **Musculoskeletal Health of Cleaners**, HSE Books, ISBN 0717624366.

Yelin, E. 1997, The earnings, income, and assets of persons aged 51-61 with and without musculoskeletal conditions, **Journal of Rheumatology**, October, 24, 10, 2024-30.



MAIL ORDER

HSE priced and free
publications are
available from:

HSE Books
PO Box 1999
Sudbury
Suffolk CO10 2WA
Tel: 01787 881165
Fax: 01787 313995
Website: www.hsebooks.co.uk

RETAIL

HSE priced publications
are available from booksellers

HEALTH AND SAFETY INFORMATION

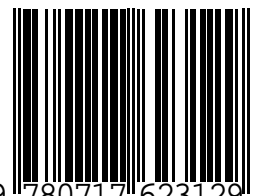
HSE InfoLine
Tel: 08701 545500
Fax: 02920 859260
e-mail: hseinformationservices@natbrit.com
or write to:
HSE Information Services
Caerphilly Business Park
Caerphilly CF83 3GG

HSE website: www.hse.gov.uk

CRR 421

£15.00

ISBN 0-7176-2312-2



9 780717 623129