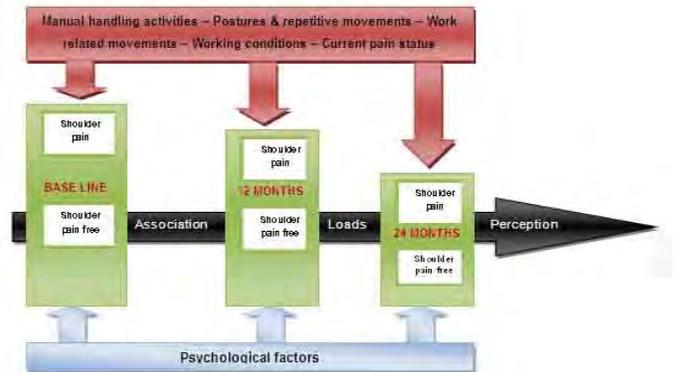


***Mechanical and psychosocial factors predict new onset shoulder pain:
A prospective cohort study of newly employed workers.***

1. What was the Prime purpose of the research and the main research questions? The main purpose of the study is the causal relationship between manual handling and the onset of shoulder pain. (see “shoulder pain exposure & outcome diagram below) [4]. To make the association, three research questions appear relevant to the report.

a. Purpose.

To test the hypothesis that work related mechanical & psychosocial factors predict new onset shoulder pain in newly employed workers



Shoulder pain exposure & outcome diagram [4]

b. Research Question(s). The research questions were designed to extract information to support the hypothesis of work and its association with the onset of new shoulder pain as indicated below:

- The relation between mechanical risk factors and shoulder pain.
- To the association between risk factors in five specific domains.
- Evaluate the relative contribution of the five domain specific exposures in symptom onset.

2. What was the design study used and was it the most suitable design? The prospective cohort study is deemed to be the best of the observational studies with a forward direction, follow up time periods and relying on the reflection of the population to provide findings. See design characteristics below:

Study design characteristics

- | | |
|---|---|
| <ul style="list-style-type: none"> • Association of shoulder pain & psychosocial factors • Examines multiple effects and exposure • Relationship between shoulder pain & occupations • Minimises the healthy worker effect [2] • Measurement bias is reduced | <ul style="list-style-type: none"> • Little or no reflection thus reducing bias • Identifies the relative preventive action required • Follow up is valid but just less than 80% • Base-line predictors of shoulder pain & at follow up • Validated self completed questionnaire |
|---|---|

Another study type that may have been used would be a cross sectional study. However the population in that design may not have been available and may lead to potential bias and influence of the health worker effect. Similar cross-sectional studies were found to be retrospective; based on job title (to estimate workers loads), subject to bias and confounding, and a lack of any follow which this study did not rely on. Individuals in this prospective cohort study were asked about manual handling skills for the previous day, which reduced recall bias and in addition the study was designed with the “ability to disentangle the relationship between base-line risk factors and subsequent new episodes of shoulder pain in the newly employed workers.” [1]

3. How different is the risk of shoulder pain between groups? There were 12 diverse occupational groups and selected from three sources, such as; a new work force, established organisation and a final year vocational students as the last group. In addition, to test the hypothesis, five specific domains were also examined. It was interesting to note that the onset of new shoulder pain did not differ by age and gender although men comprised a larger proportion of the study. In addition the individuals with any other previous pain also had an increased risk of new onset of shoulder pain. An analysis of risk difference between groups is best demonstrated by this author’s Risk Analysis Matrix below:

New onset of shoulder pain Risks Analysis Matrix

Risk Domains	Sources	Occupations	Risks (not in order)
<i>Mechanical load,</i>	<i>Service or established organisations Final year students</i>	<i>Army infantry, Fire fighters Forestry workers, Nurses Ship builders</i>	<i>The greater the load the greater the risk. Physically demanding, & pushing pulling, above shoulder height. Lifting weights. Frequency, duration, carrying weights. Driving.</i>
<i>Posture & repetitive movements</i>	<i>Service or established organisations, Sites recently opened</i>	<i>Army clerks, Nurses, Postal workers, Retail workers</i>	<i>Physically demanding, Manual handling, Frequency, Lifting weights, working with hands, stretching below knee level, Driving</i>
<i>Psychological factors</i>	<i>Service or established organisations, Sites recently opened Final year students</i>	<i>Police officers, Podiatrists, Nurses, Dentists</i>	<i>Perception that work is boring and monotonous. Psychological distress, Lack of job satisfaction, stress, worry, lack of peer group support, no job control, lack of learning.</i>
<i>Working conditions</i>	<i>Final year students</i>	<i>Podiatrists, Nurses, Dentists</i>	<i>Heat, wet, cold and exposed conditions. Physically demanding. Manual handling. (Referent group was Inconclusive)</i>
<i>Other (current) pain</i>	<i>Service or established organisations</i>	<i>Army officers, Police officers</i>	<i>(Referent group was Inconclusive) All unspecified risks</i>

4. **Shoulder pain information collected. How might this affect interpretation of result? Could this have been done better?** Information was obtained by self completed questionnaires, observation, monitoring, and follow up at three time points; being base-line, 12 months and at the 24 months point. At base line 1186 individuals received a questionnaire which was completed by 1081 subjects. These were distributed in the workplace while those who were absent received postal questionnaires with two reminders sent to non-responders.

Furthermore follow-up questionnaires were posted at the 12 and 24 month point period, again with two reminders to non responders. In addition, a manikin diagram provided to record pain status (as a means of reducing recall bias) may not be typical of a normal working day. (See adjacent diagram). The follow up questionnaires at the 12 and 24 months time points may have created an environment of recall bias and measurement error which could have been overcome by reducing the perception and beliefs of the population to within five to ten days and conducted by an independent person. The reporting of monotonous (based on psychological General Health Questionnaire) work that was unable to be examined may have been overcome by an external consultant to reduce confounders and bias.



Manikin

5. **First time work force, what surprises and what are the explanations?** The authors have indicated that the study design was created to reduce the healthy worker effect by the recruitment of individuals new to the workforce and also new to manual handling activities. This new population body would explain the 24% reported at baseline. The other reason for this is based upon some of the 12 occupations which include para-military forces and professionals, the healthy worker effect would be of minimum influence in any case.

It is generally known that members in these occupations are moved onto other work or are compensated or demobilised due to the very nature of the occupation. Previous studies such as "cross-sectional have also highlighted the causal relationship between mechanical and the onset of new shoulder pain and by its nature may have overestimated some associations due to recall bias but underestimated some associations due to the healthy worker effect". [1]

6. Are there any differences between those who did and did not perform manual handling which could influence the reporting of shoulder pain?

The study had identified four areas that were categorised as the referent group who had no effect on the onset of any new episodes of shoulder pain and their influence apart from being part of the population was negligible. The referent group was made up of the following:

- Those who did not perform a manual handling activity
- Those who did not report potentially harmful work related postures and or repetitive movements.
- Those who scored zero on the general health questionnaire were also classified as referent group.
- Those that failed to respond despite two postal reminders

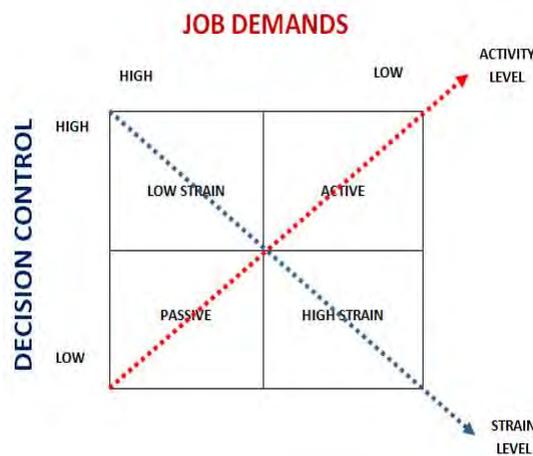
On the other hand those that were involved in the domain risk factors were at a greater risk of the onset of shoulder pain, especially those involved in the mechanical handling aspects. Those at greatest risk were individuals who were carrying, handling or lifting heavier loads and as a result were at double the risk if not more than the other five domain risks. From the psychosocial point of view those also at risk were individuals who perceived their jobs as boring and monotonous.

7. What seems to be the most risk factors for new onset of shoulder pain? Are there any unexpected findings. The most risk factors identified and surprise observations are best described in the table format below:

<i>Most risk factors</i>	<i>Surprise observations.</i>
<ul style="list-style-type: none">• The greater the load the greater the risk.• Physically demanding, pushing pulling,• Working with hands above shoulder height. (> 18 minutes)• Lifting weight and duration, (> 15 minutes)• Carrying weights.	<ul style="list-style-type: none">• Repetitive arm wrist movements• Pushing and pulling• Driving• Stretching below knee level

8. How important are the work and individual psychosocial risk factors in table 3? Any surprises? According to table 3, (apart from one set of findings), statistics do not appear to be any work association between work-related psychosocial risk factors and onset of new shoulder pain. Statistics were inconclusive for job demand, job satisfaction, social support, control over work and individual distress.

I find this rather odd in light of "Karasek's job strain model which indicates that the greatest risk to physical and mental health from stress occurs to workers facing high psychological workload demands or pressures combined with low control or decision latitude in meeting those demands." [3] See Karasek's diagram adjacent for psychosocial associations. Secondly the other surprise was to find that there is an association between monotonous and boring work with the onset shoulder pain



Karasek Job decision Model [3]

9. What are the authors' main conclusions? Are they justified considering the limitations? In the words of the authors, they found that "many previous studies of symptoms onset have been constructed in well established work forces and may be influenced by the healthy worker effect." [1] In addition, "mechanical work related risk factors were strong contributors of new onset of shoulder pain." [1] Furthermore, "the contribution of work related psychosocial factors to symptom onset was modest, although, monotonous work was an important predictor of new onset of shoulder pain." [1]

The authors have endeavoured to reduce bias, confounders and their approach to the study is the best course of action to have taken. As previously mentioned above, previous studies have been highlighted by the authors and action taken to remove and eliminate the weakness of the studies. There are strengths and weaknesses with this study, however on the balance of probabilities, the study appears to have achieved its objectives and found the associations of the onset of shoulder pain with a number of work related occupations in addition to the risk factors most likely to cause harm. Further to the above, I disagree with the authors who state that "alleviating the perception of monotonous or tedious work, interesting and varied tasks, more rest breaks, better job opportunities, enhanced communication between employees and employers may be less difficult to implement". [1] All of these items are quite possible and are being adhered to in the workplace by employers today.

10. What actions to address the problem of shoulder pain would be taken given the findings? As an OHS advisor, I would take into consideration the risks identified and reduce or eliminate them as far as possible using the hierarchy of controls, of elimination, substitution, isolation, engineering controls, administrative controls and PPE. Furthermore I would also take a pragmatic approach to the occupations where load bearing may be unavoidable in many occupations and find that psychosocial intervention may be difficult to implement. See below for risk management analysis:

Risk Domain	Risks Characteristics	Preventive action
Mechanical load,	Physically demanding, pushing pulling, above shoulder height. Lifting weights. Frequency, duration, carrying weights. Driving.	“Elimination - removal of risk by removing it or changing work processes Substitution - replacing with another with a lower risk
Posture & repetitive movements	Physically demanding, Manual handling, Frequency. Lifting weights, working with hands, stretching below knee level, Driving.	Engineering control - changing the physical characteristics to remove or reduce the risk
Psychological factors	Work is boring and monotonous. Distress, Lack of job satisfaction, worry, lack of peer group support, no job control, lack of learning.	Isolation – removing/separating people from the hazard Administrative control - using policies, procedures, signs, training etc. to control risk.
Working conditions	Heat, wet, cold and exposed conditions. Physically demanding. Manual handling.	Personal protective equipment - equipment or clothing designed to provide protection” [5]
Other (current) pain	All unspecified risks	

Further to the above, I am of the firm belief that the introduction of ergonomic and rehabilitation programmes, workplace visits, personal development training, education and social visits, informative lectures about health, well being, sick leave are considered possible. Providing there is good communication between the employer and employees.

Peter Adamis

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RESEARCH DATA

To assist during the critical appraisal, the following information gleaned from the references is for observation, comment and analysis to be utilised within the critical appraisal of the article. Mechanical and psychosocial factors predict new onset shoulder pain: a prospective cohort study of newly employed workers

NO	OBSERVATION
1	Aim. To test the hypothesis that work related mechanical and psychosocial factors predict new onset shoulder pain in newly employed workers.
2	Two year prospective study of newly employed workers from 12 diverse occupational settings.
3	At baseline, 1081 subjects provided information on work related mechanical and psychosocial risk factors, and current pain status
4	New onset shoulder pain was reported by 93 (15%) and 73 (15%) subjects respectively.
5	803 (74%) subjects were free from shoulder pain at baseline.
6	An increased risk of symptom onset was found in subjects reporting mechanical exposures involving heavy weights
7	psychosocial factors examined, the strongest predictor was monotonous work
8	In multivariate analysis, lifting heavy weights with one or two hands, pushing or pulling heavy weights, working with hands above shoulder level, and monotonous work were independently associated with new onset shoulder pain.
9	study supports the hypothesised relation between mechanical risk factors and shoulder pain
10	monotonous work was a strong risk factor for new onset shoulder pain.
11	organisational and social factors of the working environment, may lead to increased stress in individuals
12	individuals who have little control, high workplace demands, and low social support from colleagues or supervisors at increased risk of developing poor health outcomes associated with shoulder pain
13	Inconsistency in reported results may be as a result of bias as a result of the "healthy worker effect. This is due to workers who become ill changing their job or job conditions, thus leaving a relatively healthy workforce.
14	healthy worker effect may lead to an underestimate of the risk of shoulder pain

15 Studies have tended to be cross sectional and are subject to recall bias. Longitudinal studies are therefore required in order to determine the temporal relation between exposure and outcome.

16 The current study was designed as a prospective cohort study to examine mechanical and psychosocial risk factors for new onset shoulder pain in a range of occupational groups

17 To address this hypothesis we examined the association between risk factors in five specific domains (mechanical load, posture and repetitive movements, psychosocial factors, working conditions, and other pain) and the new onset of shoulder pain. We then evaluated the relative contribution of these domain specific exposures in symptom onset.

18 At baseline subjects completed a questionnaire
subject completed a 23 page questionnaire at baseline

19 Free from shoulder pain were identified and followed up at 12 and 24 months.

20 recruited from 12 diverse occupational groups

21 Occupations as having high rates of musculoskeletal disorders and thought to have a comparatively stable workforce were included

22 Three sources: (1) sites recently opened and employing a new work force
(2) service or established organisations recruiting sizeable numbers of new employees
(3) final year students completing vocational courses

23 previous studies of symptom may be influenced by the healthy worker effect

24 detailed information on five individual domains of possible risk factors for new onset shoulder pain

25 *Questionnaires 1. Manual handling activities 2. Postures and repetitive movements. (model of Karasek)*
3. Work) related psychosocial factors 4. Working conditions. (worked in hot, cold, or damp conditions)
5. Current pain status. (6) Additional General Health Questionnaire (GHQ) was included as a measure of psychological distress

26 Thinking back over the past month maybe recall bias

27 Policy implications: Load bearing is unavoidable in many occupations and psychosocial interventions may be less difficult to implement. And targeting the perception of monotonous work may be one possible avenue for intervention.

28 Follow up questionnaires were mailed to subjects at 12 and 24 months New onset shoulder pain was defined in a similar manner to baseline

29 At baseline a cohort free from shoulder pain was identified. Associations between (1) exposures at baseline and new onset shoulder pain at 12 months and (2) exposures at 12 months and new onset of shoulder pain at 24 months (fig 1) were examined.

30 Referent group subjects who did not perform a manual handling activity were categorized as the referent group.

31 Exposure and outcome data available at three time points.

32 Univariate associations, adjusted for age, gender, and occupational group

33 multivariate model was examined for interactions with other predictor variables and follow up period

34 **Prevalence of new onset shoulder pain** The prevalence of new onset shoulder pain at 12 and 24 months was the same, with 15% reporting symptoms at both follow up periods (n = 93 and 73 respectively).

35 The prevalence rate of new onset shoulder pain did not differ by age and gender, but was found to vary by occupational group

36 univariate associations between mechanical risk factors and subsequent shoulder pain, adjusted for age, gender, and occupational group

37 All manual handling activities conferred an increased risk of shoulder pain, and those individuals who handled heavier weights had almost double or more than double the odds of developing new onset shoulder pain

38 work related psychosocial factors perception of one's work as monotonous or boring was strongly associated with new onset shoulder pain,

39 hot, cold, and damp working conditions did not predict new shoulder pain

40 Lifting weights at or above shoulder level was excluded from the final model due to the inconsistency

41 Prevalence of new onset shoulder pain was observed to increase by the number of these factors subjects were exposed to. Indicating that the model was good at predicting new onset shoulder pain.

42 Overall response rates were high but varied

43 mechanical factors are important in the new onset of shoulder pain

44 several strengths in relation to the current study

45 First, it was conducted within a newly employed workforce to minimise the healthy worker effect

46 Second, the current study was conducted as a prospective cohort study

47 Second, individuals were asked about manual handling activities and working conditions

48 Third, a proportion of subjects did not respond at follow up

49 Fourth, pain status was measured at three time points (baseline, 12 and 24 months)

50 Prevalence of new onset shoulder pain was high among newly employed workers. Musculoskeletal pain is very common

51 makes sense to establish which risk factors are important in the new onset of musculoskeletal disorders so that suitable preventative measures can be undertaken

52 prevalence rates of shoulder pain varied largely according to occupational group

53 Highest new onset prevalence rate of shoulder pain occurred at baseline. However, the fact that subjects, initially free from shoulder pain at baseline,

54 manual handling activities were found to be associated with shoulder pain

55 only a small proportion of those subjects who underwent a physical examination were diagnosed with a specific shoulder disorder

56 number of mechanisms through which psychosocial factors may influence new onset musculoskeletal pain have been hypothesised

57 relatively short period that the majority of psychosocial risk factors did not predict new onset shoulder pain

58 Ergonomic interventions and rehabilitation programmes for the prevention of musculoskeletal disorders are currently in their infancy

DEFINITIONS

The following definitions are for explanatory and supporting materials to the appraisal:

1	<p>Healthy Worker Effect. [2] Phenomenon of workers' usually exhibiting overall death rates lower than those of the general population due to the fact that the severely ill and disabled are ordinarily excluded from employment.</p>
2	<p>Karasek's job strain model. [3] A new model of job stress (see figure) developed by Robert Karasek has highlighted two key elements of these stressors, and has been supported by a growing body of evidence. Karasek's "job strain" model states that the greatest risk to physical and mental health from stress occurs to workers facing high psychological workload demands or pressures combined with low control or decision latitude in meeting those demands.</p>
3	<p>Hierarchy of control. [5]</p> <p>The descending order of effectiveness of different types of control measures that may be applied following an assessment of possible risk control:</p> <ul style="list-style-type: none"> • elimination - most effective control measure, involves removal of risk by removing it or changing work processes • substitution - replacing the plant or substance with another with a lower risk • engineering control - changing the physical characteristics of plant or workplace to remove or reduce the risk • isolation - removing or separating people from the source of the hazard • administrative control - using policies, procedures, signs, training etc. to control risk • personal protective equipment - equipment or clothing designed to provide protection