Miranda H, Punnet L, et al. Physical work and chronic shoulder disorder. Results of a prospective population-based study. Ann Rheum Dis 2008;67:218–223.

Design: Prospective population-based study

Study question: Can shoulder pain be predicted by work factors such as heavy workload, working in awkward positions, repetitive movements, and vibration, either alone or in combination?

Population/sample size/setting:

- Baseline data collection for the Mini-Finland Health Survey began in 1977-80, to represent Finnish adult population 30 years or older with a sample of 8000 eligible for the screening phase of the study, with 90% participation (n=7217)
    - Screening phase collected data using questionnaires, interviews, standard lab and functional tests
    - Risk factors were elicited by self-report questionnaires, which asked about lifting heavy loads, work in twisted postures, work involving vibration, much standing, repetitive movements, or work paced by a machine
        - These risk factors were reported for the current job and the previous job of longest duration, and coded as either present (1) or absent (0), then added together to yield an index of physical stress at work on a scale of 0 to 5
    - Participants with shoulder pain in the previous month, or limited performance in functional screening tests (such as active shoulder abduction), were examined by a physician
- 20 years later, in 2000-2001, a new national health examination survey was conducted, and a sample of 1286 subjects from the original cohort were invited to be re-examined; 909 participants (42% men, mean age 64.2) participated in the followup examination
- Among these 909 subjects, 883 who had no chronic shoulder disorder at baseline were available for an analysis of the incidence of chronic shoulder disorder

Associations between exposure and outcome:

- The 883 participants in the followup study completed a standard clinical examination protocol by a physician, supplemented by detailed medical history from medical records on previous shoulder diagnoses, treatments, sick leave, and x-rays
    - Specific diagnoses included rotator cuff tendinitis, biceps tendinitis, frozen shoulder, inflammatory arthritis, post-traumatic shoulder condition, and other non-specific shoulder disorder

    - Chronicity was defined as symptoms preceding the examination by at least three months
- The associations of work factors and chronic shoulder pain were adjusted for age and gender, but analyses were also stratified by gender, with separate reporting of odds ratios for all subjects, for men, and for women
- A chronic shoulder disorder was diagnosed at followup in 63 subjects, either as a new diagnosis at the time of the physical examination or as a recent diagnosis from medical records in the preceding 5 years
- In the multivariable analysis, all physical workload factors combined were statistical predictors of chronic shoulder disorder
- The 5 separate physical workload factors were correlated with one another; the separate contribution of individual factors therefore could not be accurately estimated
- Each of the 5 factors was statistically associated with shoulder disorder except work paced by a machine
- The highest odds ratios were for repetitive movements (odds ratio of 2.3) and for vibration (odds ratio of 2.7)
- Combined physical workload (sum index of 3-5 compared to sum index of 0) had an odds ratio of 3.9
- Gender had some effect on the estimates of work factor association with shoulder pain
    - Too few women were exposed to vibration and repetition to have a statistical association
- Age had some effect on the odds ratio for lifting heavy loads; for age 30-45, there was a non-significant odds ratio of 1.1; for age over 45 the odds ratio was 3.1
- Obesity had an effect on the odds ratio for awkward posture; it was significant for non-overweight workers with BMI less than 25 (odds ratio of 3.4), but not for BMI>25 (odds ratio of 1.1)

Authors' conclusions:

- Even after a followup period of 20 years, occupational physical exposures predicted future shoulder disorders
    - Of five work factors measured, four (lifting heavy loads, vibration, repetition, and awkward postures) increased the risk by 80 to 150%
- Even among people who had retired from the workforce, the risk of shoulder disorder remained associated with earlier work factors
- The apparent ameliorating effect of increasing BMI could have been related to increased self-reporting of exposure in workers of BMI>25; this did occur and was not dependent on age, gender, baseline symptoms ,or education
- The statistical power was limited because there were only 63 incident cases among the 833 participating subjects

- There was no information on work history after the baseline but it was assumed that exposure to specific features of physical work did not change markedly during work life; this was supported by some population-based survey data showing that for a majority of workers, these factors did not change over time

Comments:

- The definitions of exposure are not specified in the text of the article
    - The authors say in the methods section that the baseline data collection has been described "elsewhere"
    - The reference for "elsewhere" is *Musculoskeletal diseases in Finland*, which is said to be published in Finnish in 1993, with an English summary at the Social Insurance Institution in Helsinki
    - This document does not appear to be available online
- A separate article by the same lead author (Miranda 2005) appears to evaluate the same physical work factors, and the text of this study is similarly vague about exposure definitions, but there is an online data supplement in which the following factors were enumerated
    - Frequent lifting (>=5 kg, >=2 times/min, >2 hr/day)
    - Heavy lifting (>20 kg, >10 times/day)
    - Working with a hand above shoulder level (>=1 hr/day)
    - Work requiring high hand force (>=1 hr.day)
    - Work requiring repetitive motion of the hand or wrist (>=2 hr/day)
    - Working with a vibrating tool (>=2 hr/day)
- Even in this supplement, "repetitive" motion of the hand or wrist is not defined in terms of cycles per minute, nor is "high hand force" defined; "awkward postures" as described in the article ("twisted, bent, or otherwise uncomfortable working positions") does not seem to correlate with "hand above shoulder level"
- There are a number of specific shoulder diagnoses which could be encompassed within the case definition; the clinical examination is not sufficient to make specific diagnoses, and even if the cases were broken down by specific diagnosis, there would probably be too few incident cases to yield stable logistic regression coefficients
- The great advantage of this article is that the issue of temporality is clarified by the inclusion only of new cases which occurred during followup
- Due to the lack of clear exposure definitions, the work-factor associations with shoulder pain can only be expressed qualitatively
- An English version of the Finnish questionnaire has been obtained from the authors, and this did clarify that the frequent lifting, heavy lifting, and overhead work exposures are as listed above; heavy work includes digging, shoveling and pounding

- However, the question on hand force and repetitive motion are focused on the hand and wrist, not on the shoulder; there is not sufficient evidence to link repetition at the shoulder to any shoulder diagnoses

Assessment: Adequate for some evidence that several physical work factors are likely to lead to chronic shoulder pain; these include working above shoulder level more than one hour per day, lifting more than 5 kg at least 2 times per minute for 2 hours per day, lifting or carrying items heavier than 20 kg at least 10 times per day, and heavy work such as digging, shoveling, or pounding

Reference:

Miranda H, Viikari-Juntura E, et al. A Population Study on Differences in the Determinants of a Specific Shoulder Disorder versus Nonspecific Shoulder Pain without Clinical Findings. Am J Epidemiol 2005;161:847–855 (including data supplements)

Miranda musculoskeletal questionnaire 2000.pdf