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Epidemiologically based reference values for postural load of the shoulder

For years scientists have kept saying that elevated postures of the arm are a risk factor for shoulder disorders, but it is not known how much elevation and for how long is too much (1). Others have called for more precision in exposure assessment in epidemiologic studies, emphasizing the importance of the intensity, frequency, and duration of exposures (2).

The article by Punnett and her co-workers (3) on shoulder disorders in this issue of the *Scandinavian Journal of Work, Environment & Health* is important for practitioners and scientists in occupational health and ergonomics, and also for others involved in the prevention of musculoskeletal disorders. This study found a dose-response relationship between the duration of severe shoulder flexion or abduction as a proportion of cycle time and shoulder disorders. The risk was clearly increased for severe shoulder flexion or abduction (>90 degrees) for less than 10% of the cycle time, and it increased when the proportional duration was 10% or more.

The authors made considerable effort to assess also forces imposed on the shoulder joint and used a biomechanical model to incorporate posture and hand loads into a common metric of force. They failed, however, to show an elevated risk for force, probably because the worktasks used in this study did not involve the exertion of high forces. The repetition rate of arm movements was also observed. But it correlated strongly with shoulder elevation, and its effects could not therefore be distinguished.

The strength of this study is its objective assessment of its outcome and exposure. Not all the cases had positive clinical findings, but the risk estimates were slightly higher for those with clinical findings, and the results therefore suggested an even stronger association between clinically manifest disease and postural load. The exposure assessment included the intensity, frequency, and duration of shoulder postures and resulted in a multitude of data that required careful data reduction and analysis.

The history of epidemiologic studies on shoulder disorders is short, not really starting until some 20 years ago, when a group of studies on shipyard welders was published that showed a high prevalence of shoulder disorders (4). Overhead welding was considered the main work-related factor. Later, studies among bricklayers and rockblasters showed an association between acromioclavicular arthrosis and cumulative exposure to physical loads, such as the sum of lifted tonnes during worklife (5). In the same group of workers, shoulder tendinitis was associated with cumulative vibration dose (6). A recent study found the prevalence of shoulder impingement syndrome to be higher among current and former slaughterhouse workers than in a comparison group. Video recordings of a group of the slaughterhouse workers showed that they spent half of their worktime with arm elevation of ≥ 30 degrees (7). There are no prospective studies on clinically defined shoulder disorders.

The study by Punnett and her co-workers seems to be among the most rigorous available on the association between shoulder disorders and physical workload factors. The results will be useful in the primary and secondary prevention of shoulder disorders. For monotask jobs, the results can be considered a source of reference values for the proportional duration of overhead work. The proportional durations can also be translated into minutes or hours of shoulder flexion or abduction per day.

As there are very few similar data with which to compare the results of Punnett and her co-workers' study, it is obvious that more studies are needed. At this point we can also question how much further epidemiologic studies will take us. We could probably learn more about, for example, hand loads or forces imposed on the shoulder joint with a worker population that is exposed to a wider range of forces. Other types of tasks could give us more information about the repetition rates of shoulder movements.

Such studies as this one bring us to the contact surface between epidemiologic and experimental research; more information on shoulder postures, hand loads, arm movement frequencies, and their combinations can be obtained largely in the laboratory. But, as we all know, we are unlikely to have a clinically relevant health outcome in the laboratory. Reference values can then be subjected to further reasoning by collecting the best available epidemiologic and experimental data and looking for patterns of dose-response between exposures and outcomes and interactions between exposures.

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