

Griffith LE, Shannon HS, et al. Individual Participant Data Meta-Analysis of Mechanical Workplace Risk Factors and Low Back Pain. Am J Public Health 2012;102:309-318.

Design: Meta-analysis of individual data of observational studies

PICOS:

- Population: Workers in studies which reported workplace biomechanical risk factors in relation to low back pain (LBP)
- Intervention/exposure: Physical load or trunk posture during work based on job title, self-report, direct observation, or technical assessment
- Control/comparison: Absence, or different levels, of the physical load and trunk postures used to estimate risk of LBP
- Outcome: LBP based on pathology, symptoms or signs of nonspecific LBP, time off work, medical treatment/disability attributed to LBP
- Study types: Any cohort, cross-sectional or case-control study that related workplace risk factors to LBP

Study type and selection:

- Databases searched were: MEDLINE 1966-2005, EMBASE 1988-2005, CINAHL 1982-2005, PsychINFO 1974-2005, Safety Science and Risk abstracts 1981-2005, and Institute for Work and Health (Toronto) database
- Studies of LBP attributable to pathologies unrelated to workplace factors (cancer, pregnancy) were excluded; also excluded were studies of nonwork exposures or single work-related events directly precipitating back injury, studies in which groups differed only in exposure to whole-body vibration, studies involving children, and aviation studies examining g-force exposures
- Two authors screened titles and abstracts of 4902 articles, and 220 studies met all inclusion criteria reporting unique data sets
- Contact information was available the authors of 209 of the 220 studies, all of whom were contacted with requests for raw data on individual participants; 97 authors agreed to furnish their data
- Because of limited resources, a subset of 48 primary studies (22 cohort, 4 case-control, and 22 cross-sectional) was chosen for analysis of their data sets

Analytical methods:

- Outcomes were grouped into 4 types: pathology, symptoms, functional limitations, and participation/work indicators
 - o LBP outcomes were grouped into three time frame definitions: LBP in the past 6 months to 2 years, current LBP, and sick leave due to LBP
- Exposures were grouped into 8 types: job title, qualitative descriptor (e.g., heavy work), named tasks (e.g., patient lifting), force (e.g., lifting), trunk postures (e.g., bending), gross postures (e.g., kneeling), internal exposure (spinal load), and combinations (e.g., bending and lifting)
- Exposure data were collected in 1 of 3 ways

- “Time” exposure recorded the duration of an average workday in which a worker was exposed to posture or force, expressed as a percentage of an 8 hour day
- “Task” exposure represented the percentage of job tasks which required the particular posture or application of force
- “Any” exposure was based on whether the person’s job required any time in the particular posture or applying the force
- Cohort studies were considered in 2 ways: first, by counting all LBP events regardless of baseline LBP status, and second, by counting only LBP events which occurred after the beginning of the study
- For cohort studies, 1 year was the most common length of follow-up, and the time point closest to 1 year was used for combining study data
- 4 quality items were rated: participation rate >80%, reliability of outcome measure reported, reliability of exposure measure, and dose-response analysis; exposure was classified as either self-report or direct observation
- Potential confounders were evaluated by comparing the crude odds ratio (OR) with the OR adjusted for the confounder; if the adjusted OR changed by 20% from the crude OR, the confounder was considered “strong”; if the OR changed by 10-20%, the confounder was considered “moderate”
- To explore whether posture and force exposures were independently associated with LBP, the authors restricted the analysis to studies which collected both non-neutral postures and lifting exposures, running 1 analysis with only the posture variable, 1 analysis with only the force variable, and 1 analysis with both variables

Results:

- 18 studies with 25,513 individuals included at least 1 outcome and exposure combination amenable to analysis
- Many sub-analyses were done; the overall odds ratios for LBP and posture were between 1.1 and 2.0, and the OR for LBP and force were between 1.4 and 2.1
- However, some summary estimates were affected by substantial heterogeneity, the greatest heterogeneity was for the OR (1,47) between the “time” spent in a particular posture and sick leave due to LBP (83% heterogeneity); for heavy lifting and sick leave from LBP, the OR was 2.11 with no heterogeneity
 - The most consistent sources of heterogeneity arose from differences between studies on age, sex, study design (cross-sectional vs. cohort), type of exposure measurement (observation vs. self-report), and study population (general population vs. workplace-based)
 - Older workers and men tended to have higher odds ratios than younger workers and women
- The authors found evidence that posture and force were independently related to LBP; both working in a non-neutral posture (OR=1.6) and lifting (OR=1.2) were predictive of LBP in the previous 6 to 24 months

- Only education was a strong confounder; it reduced the OR for posture and LBP sick leave from 2.2 to 2.2; no other potential confounders had evidence of strong confounding

Authors' conclusions:

- Individual participant level meta-analysis provides a method to examine individual level factors in a way that cannot be done the meta-analysis is based on aggregate data from the included studies
- However, individual level meta-analysis is resource- and time-intensive, and may be best suited to areas of public health importance where there is a lack of consensus in interpreting current evidence
- Physical workload as measured by heavy lifting and awkward postures is likely to predict LBP
 - o This relationship is more likely to be observed in younger than in older workers, possibly because of the healthy worker effect, in which vulnerable workers are self-selected out of physically demanding jobs

Comments:

- Even though there were many complex analytical issues involved, lifting and awkward postures were repeatedly associated with LBP, and in particular with sick leave due to LBP
- Workplace-based studies had lower odds ratios than population-based studies, probably because persons able to work are more similar to one another than to persons unable to work
- The authors did note that there may have been some selection bias involved in using data from study authors who provided their raw data; larger more recent studies were more likely to provide their raw data

Assessment: Adequate for evidence that posture and lifting are associated with LBP