

Punnett: Scholarly Interests and Key Publications

Work-Relatedness of Musculoskeletal Disorders (MSDs)

There has been substantial discussion in recent years of whether or not MSDs are causally associated with physical workload, whether dose-response curves can be defined, what proportion can be attributed to work demands, and how that should be partitioned between physical and psychosocial stressors. Some of this discussion occurred specifically in the context of OSHA's attempt to establish an Ergonomics Standard to protect employees from work-related MSDs, which was ultimately unsuccessful. Challenges in interpreting the literature include the diversity of exposure assessment methods, definitions of endpoints, and other methodologic issues. We have also used international data to estimate that about 37% of low back pain world-wide could be attributable to working conditions.

Punnett L. Commentary on the scientific basis of the proposed Occupational Safety and Health Administration Ergonomics Program Standard (invited editorial). *J Occup Environ Med* 2000; 42(10):970-981.

Punnett L, Pruss-Ustin A, Nelson D I, Fingerhut M, Leigh J, Tak SW, Phillips S. Estimating the global burden of low back pain attributable to combined occupational exposures. *Amer J Industrial Med* 2005; 48:459-469.

Punnett L, Wegman DH. Work-related musculoskeletal disorders: The epidemiologic evidence and the debate. *Journal of Electromyography and Kinesiology* 2004; 14 (1): 13-23.

Methods for Workplace Assessment

I am especially interested in the characterization of multiple job features in large epidemiologic studies and the role of work organization in explaining patterns of physical and psychosocial exposures. We were fortunate to have a large construction "laboratory" in Boston in the 1990's: the "Big Dig," i.e., the Central Artery/Third Highway Tunnel Project. In the [Construction Occupational Health Project](#) we developed the Posture, Activities, Tools and Handling (PATH) method and examined sources of variability in ergonomic exposures in highway construction. We have since continued to refine the PATH method and adapt it to other work settings, such as health care, agriculture, and manual material handling in the retail sector. These experiences have also informed an evolving overview of job analysis methodologies.

Physical Ergonomic Exposures:

Buchholz B, Paquet V, Punnett L, Lee D, Moir S. PATH: A work sampling-based approach to ergonomic job analysis for construction work. *Applied Ergonomics* 1996;27:177-87.

d'Errico A, Gore R, Gold JE, Park JS, Punnett L. Medium- and long-term reproducibility of self-reported exposure to physical ergonomics factors at work. *Applied Ergonomics* 2007; 38(2):167-75.

Paquet V, Punnett L, Woskie S, Buchholz B. Reliable exposure assessment strategies for physical ergonomic stressors in construction and other non-routinized work. *Ergonomics* 2005; 48(9):1200-1219.

Paquet VL, Punnett L, Buchholz B. Validity of fixed-interval observations for postural assessment in construction work. *Applied Ergonomics* 2001; 32(3):215-224.

Tak SW, Punnett L, Paquet V, Woskie S, Buchholz B. Estimation of compressive force on the lumbar spine from categorical posture data. *Ergonomics* 2007; 50(12): 2082–2094.

Organizational Features of Work:

- Bond MA, Kalaja A, Markkanen P, Cazeca D, Daniel S, Tsurikova L, Punnett L. Expanding Our Understanding of the Psychosocial Work Environment: A Compendium of Measures of Discrimination, Harassment & Work-Family Issues. National Institute for Occupational Safety and Health, Cincinnati OH, DHHS (NIOSH) Pub. No. 2008-104.
- Cifuentes M, Gore R, Boyer J, Tessler J, d'Errico A, Scollin P, Lerner D, Kriebel D, Punnett L, et al. Inter-method agreement between O*NET and survey measures of psychosocial exposure among healthcare industry employees. Amer J Industrial Med 2007; 50(7):545-553.
- d'Errico A, Gore R, Gold JE, Punnett L. JCO scale reliability and responsiveness to changes in manufacturing process. Amer J Industr Med (MS id # AJIM-07-0049.R2, accepted Oct 2007).
- Gold JE, Park JS, Punnett L. Work routinization and implications for ergonomic exposure assessment. Ergonomics 2006; 49(1):12-27.
- MacDonald LA, Karasek RA, Punnett L, Scharf T. Covariation between workplace physical and psychosocial stressors: Evidence & implications for occupational health research & prevention. Ergonomics 2001;44:696-718.
- MacDonald LA, Härenstam A, Warren ND, Punnett L. Incorporating work organization into occupational health research: An invitation for dialogue. Occup Environ Med 2008; 65:1-3.
- Moir S, Paquet V, Punnett L, et al. Making sense of highway construction: A taxonomic framework for ergonomic exposure assessment and intervention research. Appl Occup Environ Hyg 2003; 18(4):256-67.

The Role of Working Conditions in Explaining Socioeconomic and Gender Disparities in Health

Differences between men's and women's patterns of injury and illness may in part reflect the effects of differences in occupation and thus in their working conditions. Women are over-represented in "light," monotonous jobs that require precise, repetitive hand motions but high static loading of the neck and shoulder, with few opportunities for decision-making or job modification. Jobs at higher socioeconomic levels generally have lower physical workload and higher 'job control.' Perceptions of discrimination in the work climate may also contribute to psychosocial strain and impact on employees' health and work outcomes (see also the [UML Center for Women and Work](#), "Current Projects: Discrimination and Health").

- Bond MA, Punnett L, Pyle JL, Cazeca D, Cooperman M. Gendered work conditions, health and work outcomes. J Occupational Health Psychology 2004;9(1):28-45.
- d'Errico A, Punnett L, Cifuentes M, Boyer J, et al. Hospital injury rates in relation to socioeconomic status and working conditions. Occup Environ Med 2007;64:325-333.
- Klitzman S, Silverstein BA, Punnett L, Mock A. A women's occupational health agenda for the 1990's. New Solutions 1990;1(1):7-17.
- Messing K, Punnett L, Bond M, Alexanderson K, Pyle J, Stock S, Wegman DH, Zahm S, de Grosbois S. Be the fairest of them all: Challenges and recommendations for the treatment of gender in occupational health research. Amer J Industrial Med 2003;43(6):618-29.
- Punnett L, Herbert R. Work-related Musculoskeletal Disorders: Is There a Gender Differential, and If So, What Does it Mean? In: Women and Health, eds. MB Goldman, M Hatch. San Diego CA: Academic Press, 2000: 474-492.
- Punnett L. Socioeconomic differences in severe back morbidity (Editorial). Occup Environ Med 2006; 63:369-370.

MSD Surveillance, Case Definitions, and Limitations of Reporting Systems

The characterization of musculoskeletal endpoints for epidemiologic studies is much debated. Administrative records such as workers' compensation claims and OSHA 200 logs of injury and illness are easily available but typically underestimate the true frequency of work-related MSDs. Self-reported symptoms are highly sensitive and inexpensive to obtain, but it is difficult to measure their validity directly. The standard physical examination maneuvers, widely used in clinical practice, have uncertain sensitivity, specificity and reliability and may not reflect adequately all of the processes that cause pain. There is a need for more and better measures, both objective - to establish a more secure diagnosis - and subjective - for better description of impact on quality of life.

Davis AM, Beaton DE, Hudak P and the Upper Extremity Collaborative Group. Measuring disability of the upper extremity: A rationale supporting the use of a regional outcome measure. Journal Hand Therapy 1999; 12(4): 269-274.

Davis L, Wellman H, Punnett L. Surveillance of work-related carpal tunnel syndrome in Massachusetts, 1992- 1997: A report from the Massachusetts Sentinel Event Notification System for Occupational Risks (SENSOR). Amer J Industrial Med 2001; 39:58-71.

Forde MS, Punnett L, Wegman DH. Pathomechanisms of work-related musculoskeletal disorders: Conceptual issues. Ergonomics 2002;45:619-630.

Gold JE, Punnett L, Katz JN. Pressure pain thresholds and musculoskeletal morbidity in automobile manufacturing workers. International Archives Environ Occup Health 2005;78.

Gold JE, Punnett L, Cherniack M, Wegman DH. Digital vibration threshold testing and ergonomic stressors in automobile manufacturing workers: A cross-sectional assessment. Ergonomics 2005; 48(1):66-77.

Hudak PL, Amadio PC, Bombardier C and the Upper Extremity Collaborative Group. Development of an Upper Extremity Outcome Measure: The DASH (Disabilities of the Arm, Shoulder and Hand). Amer J Industrial Med 1996;29:602-8.

Miranda H, Gold JE, Gore R, Punnett L. Recall of prior musculoskeletal pain. Scandinavian J Work Environ Health 2006; 32(4): 294-300.

Morse T, Punnett L, Warren N, Dillon C, Warren A. The relationship of unions to prevalence and claim filing for work-related upper-extremity musculoskeletal disorders. Amer J Industrial Med 2003; 44(1): 83-93.

Punnett L, Gold J. Work-related upper extremity disorders: Epidemiologic findings and unresolved questions. In: Johansson H, Windhorst U, Djupsjöbacka M, Passatore M, editors. Chronic Work-Related Myalgia: Neuromuscular Mechanisms behind Work-Related Chronic Muscle Syndromes. Springer Publishers, 2004.

Wellman H, Davis L, Punnett L, Dewey R. Work related-carpal tunnel syndrome (WR-CTS) in Massachusetts, 1992-1997: Source of WR-CTS, outcomes and employer intervention practices. Amer J Industrial Med 2004; 45(2):139-52.

Health-Related Selection out of the Workforce

When people leave employment because of perceived hazards and/or health effects, this leads to under-estimates of work-related morbidity. Understanding these dynamics is important for correct interpretation of epidemiologic data and also to appreciate the externalized cost to workers of occupational health problems.

- Bildt C, Alfredsson L, Punnett L, Theobald H, Torgén M, Wikman A. Effects of drop out in a longitudinal study of musculoskeletal disorders. Occup Environ Med 2001; 58: 194-199.
- Cifuentes M, Boyer J, Gore R, d'Errico A, Scollin P, Tessler J, Lerner D, Kriebel D, Punnett L, Slatin C, PHASE in Healthcare Research Team. Job strain predicts survey response in healthcare industry workers. Am J Industr Med 2008; doi 10.1002/ajim.20561.
- Katz JN, Lew RA, Bessette L, Punnett L, Fossel AH, Mooney N, Keller RB. Prevalence and predictors of long term work disability due to carpal tunnel syndrome. Amer J Industrial Med 1998;33(6):543-550.
- Katz JN, Keller RB, Fossel AH, Punnett L, Bessette L, Simmons BP, Mooney N. Predictors of return to work following carpal tunnel release. Amer J Industrial Med 1997;31:85-91.
- Punnett L. Adjusting for the healthy worker selection effect in cross-sectional studies. International J Epidemiology 1996; 25:1068-75 and 26:914.
- Park RM, Maizlish NA, Punnett L, Moure-Eraso R, Silverstein MA. A comparison of PMRs and SMRs as estimators of occupational mortality. Epidemiology 1991;2:49-59.

Musculoskeletal Disorders in Automobile Manufacturing

In a series of studies in the auto industry, we have documented multiple ergonomic exposures such as work pace, manual force, and non-neutral postures and their effects on musculoskeletal disorders (whether defined by administrative records, symptoms or physical examination). Methodological issues have included gender differences in exposure and morbidity; the magnitude of under-reporting in the OSHA log and compensation data systems; the extent of "healthy worker" selection effect in this population; and the validity of the psychophysical exposure ratings.

- Punnett L. Ergonomic stressors and upper extremity disorders in vehicle manufacturing: Cross-sectional exposure-response trends. Occup Environ Med 1998;55:414-420.
- Punnett L. The costs of work-related musculoskeletal disorders in automotive manufacturing. New Solutions: A Journal of Environ Occup Health Policy 1999;9(4):403-426.
- Punnett L, Fine LJ, Keyserling WM, Herrin GD, Chaffin DB. Back disorders and non-neutral trunk postures of automobile assembly workers. Scandinavian J Work Environ Health 1991; 17:337-46.
- Punnett L, Fine LJ, Keyserling WM, Herrin GD, Chaffin DB. Shoulder disorders and postural stress in automobile assembly work. Scandinavian J Work Environ Health 2000; 26:283-291.
- Punnett L, Gold J, Katz JN, Gore R, Wegman DH. Ergonomic stressors and upper extremity musculoskeletal disorders in automobile manufacturing: A one-year follow-up study. Occup Envir Med 2004; 61:668-674.
- Punnett L, van der Beek AJ. A comparison of approaches to modeling the relationship between ergonomic exposures and upper extremity disorders. Amer J Industrial Med 2000;37:645-55.

Work with Video Display Units

- Brisson C, Montreuil S, Punnett L. A six-month follow-up of the effect of an ergonomic training program on musculoskeletal disorders among video display unit workers. Scand J Work Environ Health 1999;25(3):255-263.

Punnett L, Bergqvist U. Musculoskeletal Disorders in Video Display Unit Work: Gender and Work Demands. In: Occupational Medicine: State of the Art Reviews, Office Ergonomics, ed. Cherniack M, Philadelphia PA: Hanley & Belfus, Inc., 1999; 14(1):113-124.

Punnett L, Bergqvist U. Visual Display Unit Work and Upper Extremity Musculoskeletal Disorders: A Review of Epidemiologic Findings. Solna SWEDEN: National Institute of Working Life, Arbete och Hälsa 1997;16:1-161. (<http://www.niwl.se/ah/1997-16.pdf>)

Won E, Johnson PW, **Punnett L**, Dennerlein JT. Upper extremity biomechanics in computer tasks differ by gender. J Electromyography Kinesiol, 2007 doi:10.1016/j.jelekin.2007.11.012.

Selected Keynote and Other Invited Lectures

"Socioeconomic Disparities in Health and in Occupational Exposures: Relevance for Workplace Health Promotion and Protection Programs." NORA Symposium, Midwest Center for Occupational Health and Safety, University of Minnesota, Minneapolis MN, June 2007.

"Inequitable Distribution of Workplace Risks: Insights from Studying Musculoskeletal Disorders." C. O. Sappington Memorial Lecture (Invited Keynote). American College of Occupational and Environmental Medicine (ACOEM), American Occupational Health Conference, New Orleans LA, May 2007.

"Work-Related Musculoskeletal Disorders in Men and Women: Is the Burden Equitably Distributed?" Invited Keynote, 28th International Congress on Occupational Health, MILAN, June 2006.

"Work Organization: Contextual Exposure Assessment for Occupational Health Epidemiology." Invited Keynote, x2004 - Exposure Assessment in Epidemiology and Practice. Utrecht THE NETHERLANDS, June 2004.

Where my former doctoral students and other advanced trainees are now:

Victor L. Paquet (graduated 1998) is now Associate Professor of Industrial & Systems Engineering and Rehabilitation Sciences at the University at Buffalo, The State University of New York. His dissertation was titled, "The assessment of ergonomic exposures in construction work."

JungSoon Park (graduated 2000) now lives in Chicago, IL. Her dissertation was titled, "Ergonomic exposure assessment and musculoskeletal disorders in automobile manufacturing."

Leslie A. MacDonald (graduated 2000) is a Research Industrial Engineer in the Industry-wide Studies Branch, Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health (NIOSH), in Cincinnati, OH. Her dissertation was titled, "Workplace stressors in mass production manufacturing: Exposure patterns and associations with upper extremity musculoskeletal disorders."

Gerard Dybel (graduated 2000) is Associate Professor in the Department of Physical Therapy at U.Mass. Lowell. His dissertation was titled, "Ergonomic evaluation of work as home health care aide: Descriptive & epidemiological analysis."

Kathleen Rockefeller (graduated 2002) is on the faculty in the Department of Physical Therapy & Rehabilitation Sciences, University of South Florida. Her dissertation was titled, "Evaluation of an ergonomic intervention in Washington State nursing homes."

Judy Gold (graduated 2002) is Assistant Professor, Department of Public Health, Temple University, in Philadelphia, PA. Her dissertation was titled, "Indicators of upper extremity musculoskeletal disorders: Digital vibration threshold and infra-red thermography."

Jenny (In-Chae) Ro (graduated 2004) now lives in Zurich, Switzerland. Her dissertation was titled, "Risk factors for musculoskeletal disorders among performing musicians."

Angelo d'Errico (Research Professor, 2002-04) is Epidemiologist in the Servizio Sovrazonale di Epidemiologia, Grugliasco (TO), Italy.

SangWoo Tak (graduated 2005) is a researcher in the Division of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health (NIOSH), in Cincinnati, OH. His dissertation was titled, "Variability of mechanical exposures in the construction industry."

Manuel Cifuentes (graduated 2006) is currently a post-doctoral research fellow in the Department of Work Environment, UML. His dissertation was titled, "Socioeconomic status and psychosocial working conditions in healthcare workers."

Helena Miranda (Post-doctoral masters student, 2005-07) is now a Researcher in the Centre of Expertise for Health and Work Ability, Finnish Institute of Occupational Health, Helsinki, Finland.

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