

NIOSH Science Blog

The Upper Limb Musculoskeletal Disorder Consortium

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As we celebrate the 50th anniversary of the National Institute for Occupational Safety and Health, we look back at many of our successful programs.

The [Upper Limb Musculoskeletal Disorder Consortium](#) is a collaborative research program to prevent work-related upper limb musculoskeletal disorders (MSDs). The Consortium studies work-related MSDs to better understand and help prevent the work-related risk factors for:

- carpal tunnel syndrome
- tendinitis of the forearm and wrist
- shoulder disorders

Origins

In the late 1990s, NIOSH, OSHA, and other government and academic occupational health partners recognized that research was needed to better understand and prevent the growing epidemic of painful, costly, and disabling work-related MSDs. While there were known associated work-related factors, there was limited evidence linking risk factors to MSDs.

NIOSH recognized that large-scale efforts were needed to conduct prospective research that included collecting detailed, individual data for thousands of participants, such as:

- detailed job physical risk factors (e.g. forceful hand exertions, repetitive hand motions, postures, use of vibrating tools),
- personal demographic and comorbidity factors (age, body mass index, other diseases)
- psychosocial factors,
- clinical examinations, and
- electrodiagnostic/nerve conduction studies (for carpal tunnel syndrome).

In 2000, NIOSH decided to support a consortium of intramural and extramural research teams using a collaborative program model to address these data deficits. This model balanced the need to collect high-quality data with similar variables that could be pooled while allowing extramural researchers the freedom to design and conduct their own studies.

Partnerships and Collaboration

Research partnerships that began at the inception of the Consortium endure today. After 21 years, a large, thriving community of individuals and research organizations remain dedicated to understanding and preventing upper extremity MSDs. The six extramural Consortium study sites include: University of California, San Francisco; University of Connecticut; University of Iowa; University of Utah/University of Wisconsin, Milwaukee; Washington State Department of Labor and Industries, Safety & Health Assessment & Research for Prevention Program (SHARP), and Washington University in St. Louis.

To date, Consortium members have produced over 100 peer-reviewed journal articles and additional analyses are ongoing. The studies have included more than 4,000 workers in healthcare, manufacturing, agriculture, forestry, and construction settings.

The success of the Consortium studies requires enduring personal and professional relationships. Close coordination is required between ergonomists, engineers, health professionals, epidemiologists, biostatisticians, management, and workers at each research site. The projects have also served as an important training opportunity for the next generation of

occupational health researchers and practitioners.

Impact

The following are examples of the far-reaching impact of the Consortium:

- Adopted in 2001, the American Conference of Governmental Industrial Hygienists (ACGIH®), Threshold Limit Value (TLV) for Hand Activity Level (HAL) is one of the most used biomechanical risk assessment tools by U.S. industry. The HAL TLV considers the frequency and duration of hand exertions and recovery periods combined with measures of peak hand force. In 2017, ACGIH announced a change in the HAL TLV and Action Limit. The proposed revisions were partially based on the published results from the Consortium's pooled carpal tunnel syndrome analyses and other prospective studies. The Consortium results provided more precise risk estimates than prior studies and found that the 2001 TLV and Action Limit were not adequately protective ([see related blog](#)).
- The Consortium findings have led to a more accurate understanding of risk factors for upper extremity MSDs. For example, the studies verified that biomechanical, personal, and psychosocial factors all are risk factors for upper extremity MSDs. The studies from this collaboration have examined individual MSD risk factors, including age, gender, body mass index (weight in relation to height), and medical conditions such as diabetes and thyroid disorders. Hand force was the strongest and most consistent of the biomechanical factors. This is in contrast with the prevailing prior opinion that hand repetition was most important. While posture is still considered a possible risk factor, the posture exposure data was limited, and the Consortium studies were unable to confirm it as a risk factor.
- Consortium studies informed the Revised Strain Index (1) which improved upon the original Strain Index (2), which is a widely used method for assessing risk of developing hand, wrist, or elbow MSDs.
- The Consortium findings continue to provide useful data for the design of work to reduce risks of upper extremity MSDs. The findings have informed most biomechanics and human factors courses in the U.S. and are being used by some employers to successfully reduce upper extremity MSDs. Longer-term impacts are likely to include additional, significant reductions in upper extremity MSDs through both job design and re-design.
- Another benefit of these partnerships was over \$3 million in funding to the Rocky Mountain Center for Occupational and Environmental Health since 2005. With broad support from industry partners, the Utah legislature created a tax credit so that donations to the Rocky Mountain Center for Occupational and Environmental Health can be credited toward workers' compensation-related tax assessments. The tax credit was doubled in the 2021 Utah Legislative session.
- The impact of these partnerships has benefited the international occupational and environmental health and safety community and the new knowledge has extended to other scientific fields, such as rehabilitation-medicine, neurology, orthopedics, physical therapy, and biostatistics.

These impacts can be attributed to the detailed data collection methods, prospective study designs, long duration of data collection, varied industry partners, large number of study subjects, careful pooling and analysis of data, and lasting research partnerships.

For links to past publications, please visit the [Upper Limb MSD Consortium webpage](#). For more information about current Consortium activities, contact Alysha Meyers (NIOSH) itm4@cdc.gov or the Consortium data steward, Carisa Harris (University of California, San Francisco) Carisa.Harris-Adamson@ucsf.edu.

This blog is part of a [series](#) for the NIOSH 50th Anniversary. Stay up to date on how we're celebrating NIOSH's 50th Anniversary on our [website](#).



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NIOSH would like to thank the members of the Upper Limb Musculoskeletal Disorder Consortium for their contributions.

References

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