

**University of California, San Francisco & Berkeley**

**CURRICULUM VITAE**

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**EDUCATION**

2008 - 2011	University of California, Berkeley	PhD Environmental Health Sciences
2005 - 2008	University of California, Berkeley	MS Environmental Health Sciences
1998 - 2002	San Francisco State University	MA Kinesiology
1999 - 2001	University of California, San Francisco	MS Physical Therapy
1991 - 1997	Tufts University	BS Psychology

**LICENSES, CERTIFICATION**

2001	Licensed Physical Therapist in the State of California
2014	Certification of Professional Ergonomists, Board of Certified Professional Ergonomists

**PRINCIPAL POSITIONS HELD**

2016 - present	University of California, San Francisco	Assistant Professor	Medicine
2010 - 2015	Samuel Merritt University	Assistant/Associate Professor	Physical Therapy
2011 - 2013	University of California, Berkeley	Post-Doctoral Scholar	Environmental Health Sciences

2005 - 2010	PreCare Inc	Director of Research and Development	
2004 - 2005	NovaCare	Staff Physical Therapist	Outpatient Orthopedic Clinic
2002 - 2003	St. Luke's Hospital	Staff Physical Therapist	Outpatient Orthopedic Clinic

**OTHER POSITIONS HELD CONCURRENTLY**

2018 - present	Center of Occupational and Environmental Health	Deputy Director
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**HONORS AND AWARDS (SELECTED)**

2010	1st place, PREMUS Best Paper Competition, Workplace and individual factors of wrist tendinosis among blue-collar workers- the San Francisco study.	7th International Conference on Prevention of Work Related Musculoskeletal Disorders (PREMUS), Angers, France
2011	Best Student Paper Award, Ergonomic evaluation of an alternative tool for cake decorating.	Human Factors and Ergonomics Society Conference, Las Vegas, Nevada
2013	M. Donald Whorton Writing Award, Honorable Mention	Northern California Center of Occupational and Environmental Health, University of California at Berkeley, Berkeley California
2015	Don Chaffin Award, Best Ergonomics Speaker/Presentation	American Industrial Hygiene Conference and Exposition Salt lake City, Utah
2018	Bullard-Sherwood Research to Practice Award, Honorable Mention	National Institute for Occupational Safety and Health

**KEYWORDS/AREAS OF INTEREST**

Occupational epidemiology, carpal tunnel syndrome, wrist tendinosis, injury prevention, ergonomics, upper extremity disorders, exposure assessment, biomechanical, work-disability, personal monitoring devices, exoskeletons

**SELECTED INVITED PRESENTATIONS - INTERNATIONAL**

2018	Hand force and posture estimations of the distal upper extremity using surface electromyography and inertial measurement units. International Ergonomics Association Congress, Florence, Italy.	Presenter
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2018	Calculating the recommended cumulative recovery allowance across different tasks. International Ergonomics Association Congress, Florence, Italy.	Presenter
2018	Is it all about posture? A closer look at neck and shoulder MSDs. Biomechanical risk factors for musculoskeletal disorders of the neck and shoulder in a prospective cohort of production workers. International Ergonomics Association Congress, Florence, Italy.	Presenter
2018	Speed Hand Activity Level (HAL) Matches Observer Estimates Better than Frequency HAL. International Ergonomics Association Congress, Florence, Italy.	Co-Author
2018	A multi-disciplinary approach to Ergonomics Education: lessons learned from the UCSF/UCB Ergonomics Research and Graduate Training Program. International Ergonomics Association Congress, Florence, Italy.	Presenter
2018	The impact of heavy load carrying on musculoskeletal pain and disability among women in Shinyanga Region, Tanzania. International Ergonomics Association Congress, Florence, Italy.	Co-Author
2018	Ergonomic evaluation of an endoscope support stand during simulated colonoscopies. Digestive Disease Week. Washington, DC	Co-Author
2019	The Effect of Right Truncation Bias on Biomechanical Factor Risk Estimates for CTS. International Epidemiology in Occupational Health Conference; New Zealand.	Co-Author
2019	Defining repetitive hand exertions for exposure assessment. 10th Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders; Bologna, Italy.	Presenter
2019	The revised 2018 ACGIH threshold limit value for hand activity: comparison to the 2001 ACGIH TLV for the prevention of carpal tunnel syndrome. 10th Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders; Bologna, Italy.	Co-Author
2019	Biomechanical risk factors for distal upper extremity tendinosis. 10th Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders; Bologna, Italy.	Presenter
2019	Insights into workplace and personal factors that predict disability related to CTS: The NIOSH Consortium Study. 10th Scientific Conference on the Prevention of Work-Related Musculoskeletal Disorders; Bologna, Italy.	Presenter- Keynote

**SELECTED INVITED PRESENTATIONS - NATIONAL**

2018	Hand posture and force estimations of the distal upper extremity using surface electromyography and inertial measuring units. Human Factors and Ergonomics Society, Philadelphia, PA.	Presenter
2018	The Effect of 5 Mechanical Gaming Keyboard Key Switch Profiles on Typing and Gaming Muscle Activity, Performance and Preferences. Human Factors and Ergonomics Society, Philadelphia, PA.	Co-Author
2018	Evaluation of an adjustable support shoulder exoskeleton on static and dynamic overhead tasks. Human Factors and Ergonomics Society, Philadelphia, PA.	Co-Author
2018	The role of research in the adoption and implementation of new musculoskeletal injury prevention standards. American Public Health Association Annual Conference, San Diego, CA	Presenter
2018	The Impact of Heavy Load Carrying Practices on Musculoskeletal Health Among Sand Miners in Nepal. American Public Health Association Annual Conference, San Diego, CA	Co-Author
2019	Emerging Robotics and Exoskeleton Technology: Implications for Worker Safety and Health. American Occupational Health Conference, Anaheim, CA.	Presenter
2019	Ergonomics: A Comprehensive Review of Musculoskeletal Disorders. American Occupational Health Conference, Anaheim, CA.	Presenter
2019	Cannabis Ergonomics. American Industrial Hygiene Conference and Exposition. Minneapolis, MN.	Co-Author
2019	The latest in Sit-Stand Research. NASA Occupational Health Conference. Langley Research Center, Hampton, VA.	Presenter
2019	The Updated ACGIH TLV for Hand Activity®. NASA Occupational Health Conference. Langley Research Center, Hampton, VA.	Presenter
2019	Recent findings from the Upper Limb Consortium Study: new approaches to risk assessment and additional health outcomes. International Human Factors and Ergonomics Society Meeting. Seattle, WA.	Presenter

2019	The impact of mouse weight and connection type on muscle activity and performance while gaming. International Human Factors and Ergonomics Society Meeting. Seattle, WA.	Co-Author
2019	Evaluation of a Trunk Supporting Exoskeleton for reducing Muscle Fatigue. International Human Factors and Ergonomics Society Meeting. Seattle, WA.	Co-Author
2019	Anthropometric Characteristics of Chinese Auricles for Ergonomic Design. International Human Factors and Ergonomics Society Meeting. Seattle, WA.	Co-Author

**GOVERNMENT AND OTHER SELECTED PROFESSIONAL SERVICE**

2018 - present	Human Factors and Ergonomics Society	Science Policy Fellow
2018 - present	International Labor Organization	International Ergonomics Association
2018 - present	State of California, Department of Industrial Relations	Subject Matter Expert

**RESEARCH AND CREATIVE ACTIVITIES**

**RESEARCH AND CREATIVE ACTIVITIES SUMMARY**

My research interest is in the field of occupational musculoskeletal injury prevention, specifically assessing the biomechanical, personal and work psychosocial factors associated with upper extremity musculoskeletal disorders (UEMSDs) and resulting disability. Understanding the causal factors associated with the occurrence of work-related injuries can facilitate successful prevention strategies and policies to reduce the frequency and severity of work related UEMSDs. My research bridges the fields of ergonomics, occupational health, biostatistics and epidemiology. My prior work found that various measures of force (peak force, forceful repetition rate, % time forceful exertion) but not repetition, per se, were strongly associated with incident carpal tunnel syndrome (CTS). However, in these analyses, measures of duty cycle and hand repetition were associated with work disability. Of interest is whether these relationships also exist for those who have not yet been diagnosed with CTS (ie., may be in early stages of development), and whether electrodiagnostic measures and/or symptoms are associated with work disability. For the past year, I have been working in a K01 career development grant entitled “Survivor Bias in a pooled longitudinal study of CTS and related disability”. I have been working on a pathway analysis of the hypothesized relationships between biomechanical exposure, work psychosocial exposure, electrodiagnostic measures, symptoms and CTS-related work disability. However, the possibility of Healthy Worker Survivor Effect bias underestimating the true association of the exposure-response relationships explored thus far requires further analysis. Therefore, my recent work has adjusted for right truncation while characterizing the exposure-response relationship between:

1. Biomechanical exposures and CTS, adjusting for personal factors and work psychosocial factors.

2. Biomechanical exposures and work disability, adjusting for personal factors and considering effect modification by work psychosocial factors.
3. Work psychosocial factors and work disability, adjusting for personal factors, and considering effect modification by biomechanical factors based on composite exposure measures (ACGIH-TLV for Hand Activity Levels).

My goal is to address biases in epidemiological research of occupational injury prevention and ergonomics to help clarify the true risk associated with various occupational exposures thus facilitating workplace injury prevention policies and interventions. My work on understanding exposure-response relationships in injury prevention has led me to develop and research novel methods for realtime exposure assessment using wearable technology. This past year we have been developing 3 novel exposure assessment wearable devices including:

- A forearm cuff and partial glove that estimate pinch and grip force, hand posture and wrist posture. Additionally, the device can measure repetition rate and duty cycle.
- A harness worn on the torso that can estimate the physical activity (walking, pushing, pulling, lifting, stooping etc) and the spinal kinematics to estimate the probability of being in a high risk group for low back disorders.
- A pocket worn device that tracks sitting, standing, perching, walking, running, stair climbing, and biking activities. Half of these activities are summarized on an app; the rest are being added. We will be using this infrastructure to develop a machine learning algorithm that cues individuals when to move to reduce the time spent in static postures, increase activity throughout the day and measure the impact on various health outcomes.
- Additionally, I am collaborating with Dr. Radwin on the validation of a direct reading video assessment instrument for repetitive motion stress

All of these projects are designed to improve the accuracy and ease of collecting physical exposure data for surveillance, assessment and intervention purposes. All of the data from the wearables are being stored on a cloud and available in the future for more epidemiological research. Concurrently, I will be applying for a grant to pooling Consortium Data on Carpal Tunnel Syndrome with a similar cohort study in Italy (OCTOPUS) to develop and assess a non-linear TLV and Action Limit for the ACGIH TLV for Hand Activity Level that is sufficiently protective of workers, with a focus on differences by gender and aging populations. This analysis, paired with wearable and/or video based exposures assessment technology, could change how we conduct surveillance and the design of jobs in the future.

In addition, our lab has been on the forefront of assessing the applications of exoskeletons to the workplace. We are currently testing torso and upper extremity support devices in the construction and warehousing sectors. We hope to continue this line of research through continued funding from CPWR.

Our lab also evaluates physical exposures experienced by physicians, specifically gastroenterologists and orthopedic surgeons, during procedures. Through clinician and industry sponsorship, we evaluate various interventions like a colonoscope stand, designed to reduce the physical workload and risk of injury among surgeons.

I also perform smaller intervention studies designed to reduce physical exposure in jobs that have a high incidence of work related UEMSDs. Examples include the assessment of a cake decorating tool, the design and testing of an alternative pallet jack handle and most recently, the assessment of a mattress lift tool for hotel room cleaners. I will continue to participate in

projects that apply epidemiological evidence to tangible workplace solutions that aim at reducing exposure in high risk jobs, particularly among vulnerable populations.

Finally, a novel line of international research has been exploring the relationship between heavy load carrying among women and incidence of musculoskeletal disorders, women's health issues (such as pelvic organ prolapse) and associated morbidity. So far, we have performed pilot studies in Nepal and Tanzania with plans to collect more data in Ethiopia this summer. Heavy load carrying for work and ADLs (collecting water, food, fuel) poses a substantial burden on women who are often removed from school at a young age to bear the burden of collecting water, food and fuel for the family. Additionally, disability from low back pain has been cited as the top driver of disability among women. This emerging topic of research will be ongoing in multiple low and middle income countries through collaborations with other researchers at the UC Berkeley School of Public Health.

### PEER REVIEWED PUBLICATIONS

1. **Harris C**, Eisen EA, Goldberg R, Krause N, and Rempel D. 1st place, PREMUS best paper competition: workplace and individual factors of wrist tendinosis among blue-collar workers- the San Francisco study. *Scan J Work Environ Health*. 2011;37(2):85-98.
2. Coelho D, **Harris-Adamson C**, Lima T, Janowitz I, and Rempel D. Correlation between different hand force assessment methods from an epidemiological study. *Human Factors and Ergonomics in Manufacturing & Service Industries*. 2011;00(0):1-12
3. **Harris-Adamson C**. and Lin J. Effect of handle design on pallet jack operations. *Ergonomics in Design: The quarterly of Human Factors Applications*. 2013;21(2):15-21.
4. **Harris-Adamson C**, Eisen EA, Dale AM, Evanoff B, Hegmann KT, Thiese M, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Gerr F, Merlino L, and Rempel D. Personal and workplace psychosocial risk factors for carpal tunnel syndrome: a pooled study cohort. *Occup Environ Med*. 2013;70(8):529-37
5. Kapellusch, J, Garg, A, Bao, S, Silverstein, B, Burt, S, Dale, AM, Evanoff, B, Gerr, F, **Harris Adamson, C**, Hegmann, K, Merlino, L, and Rempel., D. Pooling job physical exposure data from multiple sites in a study of carpal tunnel syndrome. *Ergonomics*. 2013;56(6):1021-37
6. Dale AM, **Harris-Adamson C**, Rempel D, Hegman K, Gerr F, Silverstein B, Burt S, Garg A, Kapellusch J, Merlino L, Eisen EA, and Evanoff B. Prevalence and incidence of CTS in US working populations: pooled analysis of six prospective studies. *Scand J Work Environ Health*. 2013;39(5):495-505
7. **Harris-Adamson C**, Eisen EA, Goldberg R, You D, and Rempel D. The impact of posture on wrist tendinosis among blue-collar workers – the San Francisco study. *Human Factors*. 2014;56(1):143-150.
8. Thiese MS, Gerr F, Hegmann KT, **Harris-Adamson C**, Dale AM, Evanoff B, Eisen E, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Rempel D. Effects of Varying Case Definition on Carpal Tunnel Syndrome Prevalence Estimates in a Pooled Cohort. *Arch PMR*. 2014;95(12):2320-6.
9. **Harris-Adamson C**, Eisen EA, Dale AM, Evanoff B, Hegmann KT, Thiese MS, Kapellusch J, Garg A, Burt S, Silverstein B, Bao S, Merlino L, Gerr F, Rempel D. Personal and

- workplace psychosocial risk factors for carpal tunnel syndrome: a pooled study cohort: author response. *Occup Environ Med.* 2014;71(4):303-4.
10. Kapellusch JM, Gerr FE, Malloy EJ, Garg A, **Harris-Adamson C**, Bao SS, Burt SE, Dale AM, Eisen E, Evanoff BA, Hegmann KT, Silverstein BA, Thiese MS, and Rempel D. Exposure-Response Relationships for the ACGIH TLV for Hand Activity Level: Results from a Pooled Data Study of Carpal Tunnel Syndrome. *Scand J Work Environ Health.* 2014;40(6):610-20
  11. Rempel D, Gerr F, **Harris-Adamson C**, Hegmann KT, Thiese MS, Eisen EA, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Dale AM, Evanoff B. Personal and workplace factors and median nerve function in a pooled study of 2396 US workers. *J Occupational and Environmental Medicine.* 2015;57(1):98-104
  12. Dale AM, Zeringue A, **Harris-Adamson C**, Rempel D, Bao S, Thiese M, Merlino L, Burt S, Kapellusch J, Garg A, Gerr F, Hegman K, Silverstein B, Eisen EA, and Evanoff B. General population exposure matrix applied to a pooled study of prevalent carpal tunnel syndrome. *Am J Epidemiol.* 2015;181(6):431-9
  13. **Harris-Adamson C**, Eisen EA, Kapellusch J, Garg A, Hegmann KT, Thiese MS, Dale AM, Evanoff B, Burt S, Bao S, Silverstein B, Merlino L, Gerr F, Rempel D. Biomechanical risk factors for carpal tunnel syndrome: a pooled study of 2474 workers. *Occup Environ Med.* 2015;72(1):33-41
  14. Bao S, Kapellusch J, Garg A, Silverstein B, **Harris-Adamson C**, Burt S, Dale AM, Evanoff B, Gerr F, Hegmann KT, Merlino LA, Thiese M, Rempel D. Developing a pooled job physical exposure dataset from multiple independent studies: an example of a consortium study of carpal tunnel syndrome. *Occup Environ Med.* 2015;72(2):130-7
  15. Fan J, **Harris-Adamson C**, Gerr F, Bao S, Silverstein B, Kapellusch J, Garg A, Burt S, Dale AM, Evanoff B, Hegmann KT, Merlino LA, Thiese M, Rempel D. Associations between Workplace Factors and Carpal Tunnel Syndrome: A Multi-site Cross Sectional Study. *Am J Ind Med.* 2015;58(5):509-18
  16. **Harris-Adamson C**, Eisen EA, Neophytou A, Kapellusch J, Garg A, Hegmann KT, Thiese MS, Dale AM, Evanoff B, Bao S, Silverstein B, Gerr F, Burt S, Rempel D. Biomechanical and psychosocial exposures are independent risk factors for carpal tunnel syndrome: assessment of confounding using causal diagrams. *Occup Environ Med.* 2016; 73:727-734.
  17. **Harris-Adamson C**, Mielke A, Xu X, Lin J. Ergonomic evaluation of standard and alternative pallet jack handles. *International Journal of Industrial Ergonomics.* 2016; 54:113-119.
  18. **Harris-Adamson C**, Chen B, Janowitz I, Rempel D. Ergonomic evaluation of an alternative tool for cake decorating. *International Journal of Industrial Ergonomics.* 2017; 57:63-67.
  19. Akkas, O., Lee, C. H., Hu, Y. H., **Harris Adamson, C.**, Rempel, D., & Radwin, R. G. Measuring exertion time, duty cycle and hand activity level for industrial tasks using computer vision. *Ergonomics.* 2017; 60(12):1730-1738.
  20. Dale, AM, Ekenga CC, Buckner-Petty S, Merlino L, Thiese MS, Bao S, Meyers A, **Harris-Adamson C**, Kapellusch J, Hegmann KT, Garg A, Rempel D, Zeringue A, Evanoff BA.



Incident CTS in a large pooled cohort study: Results obtained by JEM versus results obtained from observed exposures. *Occup Environ Med.* 2018; 75(10):501-506.

21. Agarwal S, Steinmaus C, **Harris Adamson C**. Sit-stand workstations and impact on low back discomfort: a systematic review and meta-analysis. *Ergonomics.* 2018;61(4):538-552.
22. Pramchoo W, Geater AF, **Harris Adamson C**, Tantrakulwanich B. Ergonomic rubber tapping knife relieves symptoms of carpal tunnel syndrome among rubber tappers. *International Journal of Industrial Ergonomics.* 2018;68: 65-72.
23. Van Engelhoven L, Poon N, Kazerooni H, Rempel D, Barr A, **Harris-Adamson C**. Experimental evaluation of shoulder-support exoskeleton for overhead work: Influences of peak torque, amplitude, tasks and tool mass. *IIE Transactions on Occupational Ergonomics and Human Factors* (In Press).
24. Kim, S., Moore, A., Srinivasan, D., Akanmu, A., Barr, A., **Harris-Adamson, C.**, Rempel, D.M. and Nussbaum, M.A. Potential of exoskeleton technologies to enhance safety, health, and performance in construction: industry perspectives and future research directions. *IIE Transactions on Occupational Ergonomics and Human Factors* (In Press)
25. Huang R, **Harris Adamson C**, Odell D, Rempel D. Design of finger gestures for locomotion in virtual reality. *Virtual Reality & Intelligent Hardware.* 2019, 1(1): 1-9
26. Yung M, Dale AM, Kapellusch J, Bao S, **Harris C**, Meyers A, Hegmann KT, Rempel Dm, Evanoff B. Modeling the Effect of the 2018 Revised ACGIH Hand Activity Threshold Limit Value (TLV) at Reducing Risk for Carpal Tunnel Syndrome, 2001-2010. *Journal of Occupational & Environmental Hygiene.* In Press.
27. Scott JG, Shore E, Brown C, **Harris C**, Rosen MA. Highlights from occupational safety and health continuing education needs assessment. *American Journal of Industrial Medicine.* 2019; 1-7.
28. **Harris-Adamson C**, Lam E, Tong AD, Hill S, Smith A. The ergonomic impact of a mattress lift tool and bottom sheet type on hotel room cleaners while making beds. *Applied Ergonomics.* 2019; 81: 102880. Online First.
29. Lin J, **Harris-Adamson C** & Rempel D. The Design of Hand Gestures for Selecting Virtual Objects, *International Journal of Human-Computer Interaction*, 2019; In press./> DOI: 10.1080/10447318.2019.1571783

## BOOKS AND CHAPTERS

1. **Harris-Adamson C**, Bao S, Evanoff B. Musculoskeletal Disorders. In: Levy BS, Wegman DH, Baron SL, Sokas RK eds *Occupational and Environmental Health*. 7th ed. New York, NY: Oxford University Press:2018.