



Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Lee specializes in slips, trips, and falls; balance recovery; fall prevention; and human movement analysis. His work combines biomechanics, physical ergonomics, and statistical modeling to evaluate movement patterns, identify mechanisms of injury, and quantify factors associated with fall risk and recovery performance. His expertise spans laboratory-based investigations, real-world movement assessment, and wearable sensor technologies.

A central focus of Dr. Lee's research has been understanding how individuals respond to and recover from trips and other losses of balance. He has studied trip recovery biomechanics in both controlled laboratory environments and real-world settings, developed novel approaches for quantifying recovery performance, and investigated interventions designed to improve balance recovery among community-dwelling older adults. His work has contributed to the understanding of fall prevention, reactive balance control, and trip-induced falls.

Dr. Lee also has specialized expertise in wearable sensing and inertial measurement units (IMUs). His research includes validating IMUs for measuring trunk kinematics during overground trips, evaluating wearable sensor applications for balance and recovery assessments, and comparing IMU-derived measures with laboratory motion-capture systems. He has leveraged wearable technologies to characterize human movement both in controlled experiments and in real-world environments where traditional laboratory methods are not feasible.

Before joining Exponent, Dr. Lee served as a Principal Data Scientist and Postdoctoral Research Fellow at the Musculoskeletal Education and Research Center at Carilion Clinic, where he supported orthopaedic research through study design, statistical analysis, and interpretation of patient-reported and performance-based outcomes. He completed his doctoral and postdoctoral training in occupational ergonomics and biomechanics at Virginia Tech, where his dissertation focused on non-treadmill trip training, inertial measurement unit validation, and real-world tripping kinematics.

Academic Credentials & Professional Honors

Ph.D., Industrial and Systems Engineering, Virginia Polytechnic Institute and State Univ, 2024

M.S., Industrial and Systems Engineering, Virginia Polytechnic Institute and State Univ, 2019

B.S., Industrial and Systems Engineering, Virginia Polytechnic Institute and State Univ, 2018

Professional Affiliations

American Society of Biomechanics

Human Factors and Ergonomics Society

Alpha Pi Mu Honor Society

Korean-American Scientists and Engineers Association

Publications

Lee Y, Alexander NB, Frank CT, Castleberry J, Madigan ML. [A pilot trial investigating feasibility and preliminary efficacy of a task-specific step training regimen to improve balance recovery among community-dwelling older adults](#). PLOS ONE 2026; 21(7):e0354677.

Lee Y, Burks WG, Pekas DR, Apel PJ, Moskal JT, Coobs BR. [Decoding the knee injury and osteoarthritis outcome score for joint replacement: a critical investigation of a common orthopaedic outcome following total knee arthroplasty](#). The Journal of Arthroplasty 2026.

Lee Y, Alexander NB, Franck CT, Madigan ML. [Sternum drop during trip recovery differs between the laboratory and real world – an exploratory pilot study](#). PLOS ONE 2025; 20(7):e0328621.

Lee Y, Madigan ML. [Sternum drop as a kinematic measure of trip recovery performance](#). Journal of Biomechanics 2025; 112499.

Lee Y, Alexander NB, Pompeii L, Nyquist LV, Madigan ML. [Wrist-worn voice recorders capture the circumstances and context of losses of balance among community-dwelling older adults](#). Journal of the American Geriatrics Society 2024; 1–6.

Lee Y, Alexander NB, Madigan ML. [A proposed methodology for trip recovery training without a specialized treadmill](#). Frontiers in Sports and Active Living 2022;4:1003813.

Lee Y, Srinivasan D, Rawlings C, Madigan ML. [Fall impacts from standing show equivalence between experts in stage combat landing strategy and naïve participants after training](#). Work 2022; 1–7.

Presentations

Lee Y, Burks G, Pekas DR, Apel PJ, Coobs BR. Relationship between KOOS JR and physical performance measures: assessing changes in function following total knee arthroplasty. The 48th Annual Meeting of the American Society of Biomechanics, Pittsburgh, PA, USA, August 13–16, 2025.

Lee Y, Alexander NB, Franck CT, Madigan ML. An exploratory comparison of recovery kinematics between lab-induced trips and naturally-occurring real-world trips. The 48th Annual Meeting of the American Society of Biomechanics, Pittsburgh, PA, USA, August 13–16, 2025.

Lee Y, Madigan ML. Evaluating sternum drop as a new trip recovery performance measure. The 48th Annual Meeting of the American Society of Biomechanics, Pittsburgh, PA, USA, August 13–16, 2025.

Lee Y, Alexander NB, Franck CT, Madigan ML. Effects of non-treadmill trip training on lab-induced trips among community-dwelling older adults. The 47th Annual Meeting of the American Society of Biomechanics, Madison, WI, USA, August 5–8, 2024.

Lee Y, Nyquist L, Alexander NB, Madigan ML. Using voice recorders to document losses of balance and their context during the daily lives of community-dwelling older adults. The 47th Annual Meeting of the American Society of Biomechanics, Madison, WI, USA, August 5–8, 2024.

Madigan ML, Lee Y, Morris MA. Whoa! Reactive balance training for fall prevention. Special spring event for Lifelong Learning Institute at Virginia Tech, Warm Hearth Village Center, Blacksburg, VA, USA, March 11, 2024.

Lee Y, Alexander NB, Franck CT, Madigan ML. Comparing trunk kinematics computed by optical marker-based motion capture system and inertial measurement units during overground trips. The 67th Annual Meeting of the Human Factors and Ergonomics Society, Washington, DC, USA, October 23–27, 2023.

Lee Y, Madigan ML. Reactive balance training for reducing trip-induced falls. Invited virtual research presentation for Outreach Physical & Occupational Therapy and Speech Rehabilitation, PLLC, New York, NY, USA, September 28, 2023.

Lee Y, Alexander NB, Franck CT, Madigan ML. Validating inertial measurement units for measuring trunk kinematics during over-ground trips. The 46th Annual Meeting of the American Society of Biomechanics, Knoxville, TN, USA, August 8–11, 2023.

Lee Y, Madigan ML. Lessons learned from a preliminary study of non-treadmill-based trip training. The 66th Annual Meeting of the Human Factors and Ergonomics Society, Atlanta, GA, USA, October 10–14, 2022.

Lee Y, Madigan ML. Non-treadmill-based trip training: a preliminary study with healthy young adults. The 20th Annual Regional National Occupational Research Agenda Young/New Investigators In-Person & Virtual Symposium, Salt Lake City, UT, USA, April 21–22, 2022.

Lee Y, Ulman S, Kim S, Srinivasan D. Effects of mental and physical fatigue inducing tasks on balance and gait characteristics. The 63rd Annual Meeting of the Human Factors and Ergonomics Society, Seattle, WA, USA, October 28–November 1, 2019.

Peer Reviews

BMC Sports Science, Medicine and Rehabilitation

Clinical Biomechanics

Discover Medicine

Gait & Posture