



Northeastern University

Bouvé College of Health Sciences



Physical Therapy Department Research

Annual Report for 2012

Prepared by:

Jack Dennerlein, Director of Research

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Mission

The Department of Physical Therapy's research mission is to build the evidence for best practices to maintain and improve the health and wellbeing of the local, national, and global community members.

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Highlights from 2012

The Department of Physical Therapy had an excellent year with regard to research in 2012. The department grew significantly with new faculty and research facilities. Researchers were very productive publishing their work and submitting new grants applications to expand our current activities in upcoming years. Highlights from the 2012 calendar year include

- 45 peer reviewed journal publications
- Over 37 peer reviewed conference abstracts, papers, and presentations
- Over 400 citations of works by PT faculty with an average H-index of 7.2
- \$5.7 million multi-year grants submitted to external agencies with PT faculty as PIs
- \$686,695 of funded research activities in 2012
- Three new tenure-track faculty
- 2,600 square footage of new research and laboratory space
- 22 Undergraduate Research Awards
- Creation and naming of the Department's Director of Research, Jack Dennerlein
- Creation and hiring of the Department's Grant's Budget Manager, Krista Robinnetta

Description of research program

The mission of research within the Department of Physical Therapy is to build the evidence for best practices to maintain and improve the health and wellbeing of the local, national, and global community members. We meet this goal successfully through a range of research projects that examine, for example, PT education methods in the fields and practice, pain and injury mechanisms in the laboratory, treatment protocols, and population based epidemiology and intervention research.

At the heart of the research is the success of the department's faculty and the resources. The department has ten tenure-track and fifteen clinical full time faculty devoted to the department's research mission. The department has 4,900 square feet of research laboratories mostly located within Robinson Hall equipped with the state of the art research equipment. Equipment include

systems to measure human motion, posture and force, neurophysiology, muscle and tissue physiology, and musculoskeletal structure and include intervention systems such as rehabilitation robots and office ergonomic furniture. Other capabilities include survey and population data base resources and software.



A strength of the research program is the department's local and global research partners. Within Northeastern the Department has strong partners with the Health Sciences Department in Bouvé College of Health Science along with research partners in the College of Engineering, College of Science, the College of Arts, Media & Design, and the College of Social Sciences and Humanities. Within Boston the faculty collaborate with centers at neighboring institutions such as Harvard Medical School, Harvard School of Public Health, Dana Farber Cancer

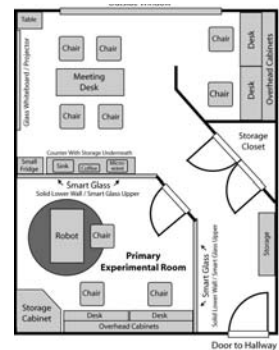
Institute, Tufts Medical Center, Boston University, Massachusetts General Hospital, Brigham and Women's Hospital, and the Liberty Mutual Research Institute for Safety. In terms of national and global partners, the Department's faculty have strong ties with the University of Massachusetts Amherst, New York University, SUNY Upstate Medical School, University of Washington, Vanderbilt, University of Southern Denmark, and VU University in Amsterdam.

Growth with new faculty, new facilities and new administration!

The department's research expanded with three new faculty starting for the 2012-2013 academic year with Assistant Professor Sheng-Che Yen, PT, PhD, Assistant Professor Christopher Hasson, Ph.D. and Professor Jack Dennerlein, Ph.D. Dr. Yen joins us from Sensory Motor Performance Program at Rehabilitation Institute of Chicago. His primary research interest is in robotic rehabilitation, motor adaptation, and coordination. Dr. Hasson joins us from Department of Biology here at Northeastern. His research aims to understand how concurrent changes in the musculoskeletal and nervous systems contribute to decrements in movement control and performance. Dr. Dennerlein joins us from the Harvard School of Public Health. His research interest is in the prevention of work-related musculoskeletal disorders and injury through experimental and observational studies of the work environment.



Along with these new faculty come 2,600 square feet of new research facilities doubling the size of the department's research space. The three new spaces will be equipped with the latest state of the art human kinesiology and rehabilitation systems.



With the expansion, the Department has added a new Director of Research and Grants Budget Manager. Dr Jack Dennerlein has 15 years of experience of leading federally funded research. As director of research, he will assist the department in identifying new opportunities for research and mentoring the development of junior faculty research programs. Ms Krista Robinnette joins the department from the University of Saint Louis. She will assist researchers within the department manage budgets related to awarded grants.

New grants!

Dr. Amee L. Seitz, PhD, PT, in collaboration with Professors Dagmar Sternad and Miriam Leeser from the College of Science and College of Engineering, recently received an Interdisciplinary Tier 1 Seed Grant to fund a project titled *“Development of an Adaptive Clinician-Friendly Virtual Rehabilitation System for Post-Operative Shoulder Therapy”*. The project aims to develop and evaluate a custom virtual rehabilitation system using low cost gaming technology, such as the Microsoft Kinect, for in-home use in patients undergoing rehabilitation following shoulder surgery. The grant will allow Dr. Seitz and her team the ability to

validate the system and test the feasibility for in-home use in a pilot study of post-operative shoulder patients. The system will provide clinicians the ability to remotely monitor a patient's home program and progress. Ultimately the use of this system can decrease cost, reduce utilization, and increase the effectiveness of post-operative rehabilitation.

Dr. Dennerlein initiated his project entitled “**Integrated approaches to health & safety in dynamic construction work environment**”, which is funded through the Harvard School of Public Health (HSPH) Center for Work, Health and Wellbeing. The goals and aims of this study are to develop and test worksite-based, multi-component, and integrated musculoskeletal disorder prevention and health promotion intervention for workers in commercial construction. This four year project will implement programs on several work-sites in the metropolitan Boston area and will then follow workers for six months after the intervention to determine changes in their health and behaviors. The HSPH Center for Work, Health, and Wellbeing (<http://centerforworkhealth.sph.harvard.edu/>) is also supporting Dr. Dennerlein's involvement in the development and testing of an integrated health intervention for patient care unit workers at two local hospitals in Boston. In addition, Dr Dennerlein worked with Dr. Dinesh John of the Department of Health Sciences in obtaining funding from the Center to pilot test the physiological effects of standing workstations on the health of sedentary and overweight office workers.



Undergraduate research:

The Department has been extremely active engaging undergraduate students in research ensuring that we integrate our research and education missions. In 2012, we had 22 Provost's Undergraduate Research Awards. Here are some highlights from this year's recipients:

Impact of Global Clinical Experiences on PT Professional Development (Lorna Hayward)

Kenny Venere and Andrea Pallais traveled with Dr. Lorna Hayward to Quito and Latacunga Ecuador to provide physical therapy services to a community partner (For His Children). To assess the impact of this 6 year initiative that has resulted in 80 NU DPT participating in this project, 6 interviews were conducted with community stakeholders. At the end of the Spring semester, an online survey will be sent to all 80 alumni to gather data on the impact of the Ecuador program on professional development and cultural competency.



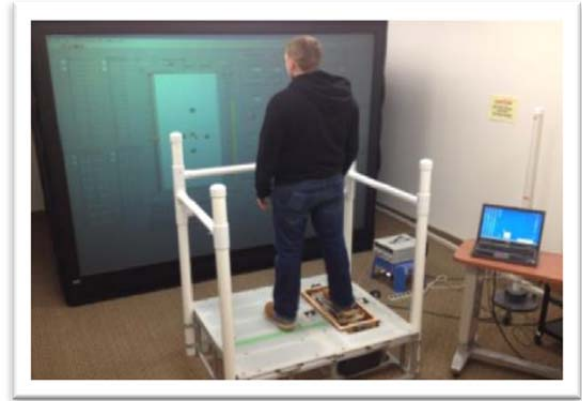
Biomechanics of the injured Shoulder (Amee Seitz)

Caralyn Baxter worked with Dr. Ameer L. Seitz in the Biomotion Research Laboratory examining modifiable mechanisms responsible for faulty biomechanics of the upper extremity associated with musculoskeletal injuries. Injuries such as rotator cuff tears or tendinopathy have a dramatic impact on a patient's ability to fully participate in activities of daily living particularly in an aging

population. Results of this project will lead to improvements in rehabilitation to restore health related quality of life and maximize functional independence.

Development of Novel Devices for Neurorehabilitation (Maureen Holden)

Ben Miller and John Corsino worked with Prof. Maureen Holden in the Neurorehabilitation Research Laboratory examining eight tasks that were designed to assess/train standing balance and pre-gait activities in patients with stroke using a newly developed rehabilitation system (NUVABAT – NU Virtual Ankle and Balance Trainer) with mechanical, virtual reality (VR) and robotic components. The purpose was to evaluate/tune parameters and difficulty levels for



these tasks with healthy subjects (n=20) prior to testing patients with stroke. We found that performance and perceived difficulty scores differed significantly for easy vs hard levels of the tasks (as expected), but surprisingly, did not differ on these factors for older vs younger subjects. Most likely this occurred because we customized the task parameter settings to each subject's initial performance abilities, a useful feature for training in patient populations. The work was presented at the National meeting of the American Physical Therapy Association, and is part of a Dr. Holden's larger project to develop the NUVABAT device for use in clinical neurorehabilitation of patients with stroke.

APPENDIX

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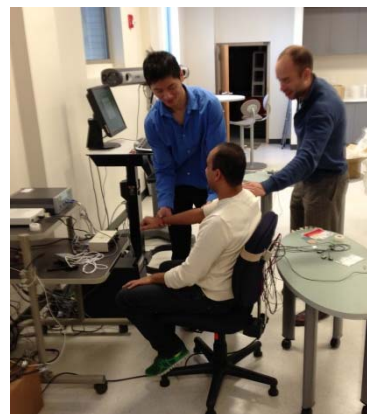
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Description of Laboratories

Occupational Biomechanics and Ergonomics Laboratory (Jack Dennerlein)

001 Robinson Hall 1190 square feet

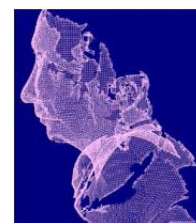
The Occupational Biomechanics and Ergonomics Laboratory research aims to prevent work-related musculoskeletal disorders by understanding injury mechanisms through laboratory and field studies that utilize biomechanics, neuromuscular, exposure-response, and intervention study designs and methods. Located on the ground floor of Robinson Hall, this space contains a state of the art office space for research staff and trainees and a human movement and biomechanics laboratory space, both approximately 600 square feet. The flexible design of biomechanics laboratory space allows for a range of experiments investigating thumb movements while using mobile computing technology to the ergonomics of dynamic office workstation designs. The laboratory contains equipment to measure human motion and posture, surface electromyography, and applied forces. Human motion equipment includes Northern Digital Optotrak system and Ascension Technology Mini-Bird systems. Electromyography equipment include a 12 channel Delsys and an 8 channel wireless Mega systems. Load cells to measure force include custom made force plates for computing to ATI 3-axis force-torque sensors.



Center for Cancer Survivorship Studies (Ann Marie Flores)

406 Robinson Hall 320 square feet

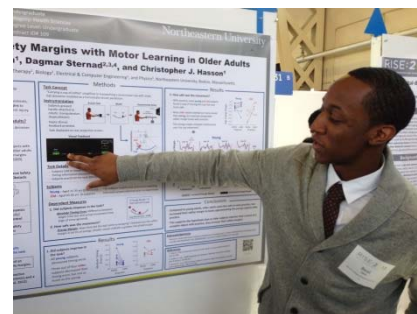
The mission of the center is to describe and evaluate issues of cancer survivorship that affect physical and functional well-being and quality of life after a cancer diagnosis with special emphasis on minorities, the poor and medically underserved. The center is also devoted to the development and testing of physical therapy and technological interventions to improve physical and functional well-being and quality of life after a cancer diagnosis. The center encourages collaborative research that includes the fields of physical therapy, biostatistics, public health, epidemiology, sociology, biomedical & biomechanical engineering, psychology, nursing, oncology (surgical, medical and radiation), pharmacy sciences, cancer, and cell biology.



Neuromotor Systems Laboratory (C.J. Hasson)

4th Floor Richards Hall 700 square feet

The goal of the Neuromotor Systems Laboratory is to understand how the nervous system learns, interacts with, and takes advantage of the properties of the musculoskeletal system and the external environment to achieve task goals. They are particularly interested in understanding how age-related changes in the neuromuscular system contribute to decrements in movement performance and stability. The laboratory's larger room will contain an isolated experimental room and a separate office area for research staff and student activities. The experimental room will house an



electromyography system (records muscle activity), a high-performance robotic arm, and high-performance computers for modeling, simulation, and data analysis. This equipment will be used to perform human motor control and learning experiments. A separate room will house Dr.

Hasson's office and a small workshop that will be used to fabricate custom apparatuses and maintain experimental equipment. <http://www.northeastern.edu/neuromotorsystemslab/>

Neurocognitive Rehabilitation Research (Prudence Plummer-D'Amato)

Lab 404 Robinson Hall 750 square feet

The mission of the Neurocognitive Rehabilitation Research Lab is to conduct interdisciplinary research along two main themes: analysis of the interactions between cognition and motor functions; and the design, development and evaluation of rehabilitation strategies for people with deficits in cognitive function and/or motor control after neurological injury. A central focus of our research is the rehabilitation of walking in community-dwelling individuals with stroke. Dr. Plummer-D'Amato's research is supported by the American Heart Association.



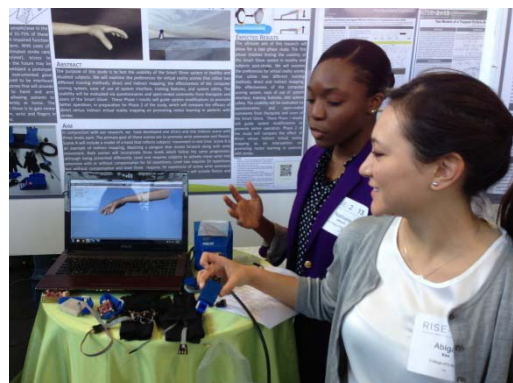
Teaching and Learning Innovation Program (Lorna Hayward)

Dr. Hayward's research centers on the scholarship of teaching and learning as it relates to student learning, cultural competency, professional role formation and novice to expert transitions. Dr. Hayward designs and examines educational models that involve the use of technology, standardized patient interactions, and experiential education in physical therapist students. Dr. Hayward's research is currently supported by the Kenneth B. Schwartz Center and the Wellesley Village Church.

Neurorehabilitation Laboratory (Maureen Holden)

402 Robinson Hall 500 Square Feet

The Neurorehabilitation Laboratory's mission is to develop new and more effective methods to rehabilitate patients with motor control deficits. In particular, we are interested in patients who have suffered neurological impairments following stroke or traumatic brain injury. We are involved in the study of sensorimotor contributions to motor control and learning, and in the development and application of newer technologies to assist neurorehabilitation. Projects include the study of motor learning and generalization using virtual environments, studies of hand motor control through the use of an instrumented glove in patients with stroke and healthy subjects, development of two novel rehabilitation devices (Smart Glove and NU Virtual Ankle and Balance Trainer) in collaboration with Prof. Constantinos Mavroidis, NU Engineering, and studies of motor retraining for patients with stroke in a rehabilitation setting in Japan, with Prof. Toshiaki Tanaka, University of Tokyo.



Rehabilitation and Epidemiology Trainee Program (Maura D. Iversen)

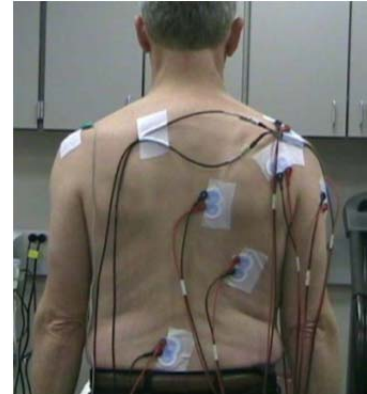
The mission of the Rehabilitation and Clinical Epidemiology Trainee Program is to provide students with exposure to clinical translational research in the area of rehabilitation sciences. A central focus of our research is the design, evaluation and implementation of behavioral and rehabilitation interventions to improve health outcomes in persons with arthritis. Specific areas of expertise include studies of persons with rheumatoid arthritis, systemic lupus erythematosus, spinal stenosis and osteoporosis. Dr. Iversen's work is /has been funded by the National

Institutes of Health, the Research & Education Foundation, Foundation for Physical Therapy, the Arthritis Foundation and Farnsworth Foundation.

Biomotion Research Laboratory (Amee Seitz)

404 Robinson 400 Square Feet

The mission of the Biomotion Research Laboratory is to investigate neuromuscular and biomechanical mechanisms, the efficacy of rehabilitation, and associated clinical outcomes of upper extremity musculoskeletal disorders related to aging and repetitive overuse during work or sport. The 400 sq. ft. dedicated research lab space, located within 404 Robinson Hall at Northeastern University, has state of the art equipment and dedicated space for motion analysis, ultrasound imaging, electroencephalography, patient examination, and computer workstations for processing and analysis. The lab pursues collaborative research in the fields of biomedical engineering, orthopedics, rehabilitation medicine, motor control and human movement science to optimize patient outcomes, participation, and health related quality of life.



Neurophysiology Laboratory (Robert Sikes)

Mugar Hall 300 Square Feet

The Neurophysiology Laboratory of the Department of Physical Therapy explores the role of limbic system brain structures in pain and stress. The lab conducts pre-clinical electrophysiological experiments using animal models of cutaneous and visceral pain. This facility is one of very few that records simultaneous neuron activity at multiple levels of the pain transmission network and is part of a multidiscipline collaboration with labs at Northeastern and Boston University Medical School which conduct the brain imaging and behavior testing of these animals. The lab is located in 319 Mugar Building which provides close proximity to the animal facilities and brain imaging center. With 300 sq-ft the lab has adequate space for neurophysiological recording in small animals, surgical procedures, histological processing, light microscopy and preliminary data analysis. The lab is equipped with state of art neurophysiological recording, stereotaxic micropositioning, stimulus control and physiological monitoring systems. For histology there is a Nikon Optiphot microscope and a microtome for tissue preparation. There are multiple computer systems including a server that provides access for remote data analysis. Additional equipment includes a fume-hood, flammable storage cabinet, refrigerator and drying oven.

Laboratory for Locomotion Research (Sheng-Che Yan)

4th Floor Richards Hall, 750 Square Feet

The goals of Laboratory for Locomotion Research are to: (a) understand how the central nervous system achieves sensorimotor control during gait; (b) develop and test gait rehabilitation programs for patients with sensorimotor control problems. The lab is located in the 4th floor of the university's Richards Hall and has a total space of 600 ft². A separate office (150 ft²) is adjacent to the lab that will be served as an examination room for healthy and patient subjects. The lab will be equipped with state of the art equipment and software for gait analysis.

Peer reviewed publications in 2012

1. Asundi K, Johnson PW, **Dennerlein JT**. Variance in direct exposure measures of typing force and wrist kinematics across hours and days among office computer workers. *Ergonomics*. 2012;55(8):874-884. PMID: 22676481.
2. Breugelmans J, LinY, Mourant RR, **Iversen MD**. Biosensor-Based Video Game Control for Physically Disabled Gamers Human Factors and Ergonomics. 2010; 54: 2383 DOI: 10.1177/154193121005402805
3. Broström EW, Esbjörnsson AC, Heideken JV, **Iversen MD**. Gait deviations in individuals with inflammatory joint diseases and osteoarthritis and the usage of three-dimensional gait analysis. *Best Pract Res Clin Rheumatology* 2012;26: 409-422.
4. Bruno Garza JL., Eijkelhofb, BHW, Johnson, PW, Raina SW. Rynellf P, Huysman MA, van Dieën JH, van der Beek A.J. Blatter, BM, **Dennerlein, JT**. Observed differences in upper extremity forces, muscle efforts, postures, velocities, and accelerations across computer activities in a field study of office workers. *Ergonomics*. Jun 2012; 55(6):670-681. PMID: 22455518
5. Buxton OM, Hopcia K, Sembajwe G, Porter JH, **Dennerlein JT**, Kenwood C, Stoddard AM, Hashimoto D, Sorensen G. Relationship of Sleep Deficiency to Perceived Pain and Functional Limitations in Hospital Patient Care Workers. *J Occup Environ Med*. Jul 2012;54(7):851-858. PMID: 22796931.
6. **Dennerlein JT**, Hopcia K, Sembajwe G, Kenwood C, Stoddard AM, Tveito TH, Hashimoto DM, Sorensen G,. Ergonomic practices within patient care units are associated with musculoskeletal pain and limitations, *American Journal of Industrial Medicine*. 2012: 55(2): 107-116. PMID 22113975
7. Eijkelhof BH, Bruno Garza JL, Huysmans MA, Blatter BM, Johnson PW, van Dieen JH, van der Beek AJ, **Dennerlein JT**. The effect of overcommitment and reward on muscle activity, posture, and forces in the arm-wrist-hand region - a field study among computer workers. *Scand J Work Environ Health*. Scand J Work Environ Health - online first. doi:10.5271/sjweh.3346. PMID: 23377125.
8. Faber GS, Chang CC, Kingma I, **Dennerlein JT**. Lifting style and participant's sex do not affect optimal inertial sensor location for ambulatory assessment of trunk inclination. *J Biomech*. Feb 7 2013. PMID: 23394716
9. Faber GS, Chang CC, Kingma I, Schepers HM, Herber S, Veltink PH, **Dennerlein JT**. A force plate based method for the calibration of force/torque sensors. *Journal of Biomechanics*, 2012: 45(7):1332-8. PMID: 22444348
10. Garza JL, Catalano PJ, Katz JN, Huysmans MA, **Dennerlein JT**. Developing a framework for predicting upper extremity muscle activities, postures, velocities, and accelerations during computer use: the effect of keyboard use, mouse use, and individual factors on physical exposures. *J Occup Environ Hyg*. Dec 2012;9(12):691-698. PMID: 23066993.
11. **Hasson CJ** and Caldwell GE. (2012). Effects of age on mechanical properties of dorsiflexor and plantarflexor muscles. *Annals of Biomedical Engineering*, 40(5):1088-1101.
12. **Hasson CJ**, Shen T, Sternad D. (2012). Energy margins in dynamic object manipulation. *Journal of Neurophysiology*, 108(5):1349:1365.
13. **Hayward LM** , Li Li. Promoting and Assessing Cultural Competence, Professional Identity, and Advocacy in Doctor of Physical Therapist Students within a Global Community of Practice. *Journal of Physical Therapy Education*. In press.

14. **Hayward LM**, Black L, Jensen GM, Mostrom E, Perkins J, Ritzline P. The First Two Years of Practice: A Longitudinal Perspective on the Learning and Professional Development of Promising Novice Physical Therapists. *Phys Ther.* 2013; 93(3):369-383. doi: 10.2522/ptj.20120214
15. **Hayward LM**, Charrette AL, Li L, Swartz BC. An Inter-professional, Culturally Sensitive, and Sustainable Service Delivery Model for the Management of Children with Severe Burns Living in China. *International Journal of Public Health.* 2013; 5(4).
16. Heideken JV, Svensson T, **Iversen MD**, Blomqvist P, Haglun-Åkerlind Y, Janarv PM. Sociodemographic factors influence the risk for femur shaft fractures in children: a Swedish case control study from 1997 – 2005. *Acta Paediatrica* 2012; DOI:10.1111/apa.12150.
17. Hopcia K, **Dennerlein JT**, Hashimoto D, Stoddard A, Orechia T, Sorensen G. Occupational Injuries for Consecutive and Cumulative Shifts Among Hospital Registered Nurses and Patient Care Associates: A Case-Control Study. *Workplace Health & Safety* 2012 Sep 24:437-444, PMID: 22998692.
18. **Iversen MD**, Brandenstein J. Do dynamic strengthening and aerobic capacity exercises reduce pain and improve functional outcomes and strength in people with established rheumatoid arthritis? *Phys Ther* 2012 doi: 10.2522/ptj.20110440
19. **Iversen MD**, Brawerman M, Iversen CN. Recommendations and the state of the evidence for physical activity interventions for adults with rheumatoid arthritis: 2007 to present. *Int J Clin Rheumatol* 2012 7(5); 1–15.
20. **Iversen, MD**, State of the Science: What do we know about rehabilitation interventions to relieve pain and disability associated with osteoarthritis? *Am J Nursing* 2012 111(3): 532-537.
21. Johnson PW, Ciriello VM, Kerin KJ, **Dennerlein JT**. Using electrical stimulation to measure physiological changes in the human extensor carpi ulnaris muscle after prolonged low-level repetitive ulnar deviation. *Appl Ergon.* May 15 2012. PMID: 22595493.
22. Kim S-S, **Dennerlein JT**, Boden L, Buxton OM, Hashimoto D, Okechukwu C, Sorensen G. Association between work-family conflict and musculoskeletal pain among hospital patient care workers. *Am J Ind Med* Sep 27 2012. PMID: 23019044
23. Mehrdad R, **Dennerlein JT**, Morshedizadeh M. Musculoskeletal Disorders and Ergonomic Hazards among Iranian Physicians. *Archives of Iranian medicine.* Jun 2012;15(6):370-374. PMID: 22642248
24. Metsis V, Jangyodsuk P, Athitsos V, **Iversen MD**, Makedon F. Computer aided rehabilitation for patients with rheumatoid arthritis. *IEEE* (In Press, 2012)
25. Momsen AM, Rasmussen JO, Nielsen CV, **Iversen, MD**, Lund H. Multidisciplinary care in team rehabilitation- overview of reviews. *J Rehabil Med* 2012, doi: 10.2340/16501977-1040
26. Örtqvist M, Roos EM, Brostrom E, Janarv P, **Iversen MD**. Development of the knee injury and osteoarthritis outcome score for children (KOOS-Child): comprehensibility and content validity. *Acta Orthopaedica* 2012;83(6):666-73
27. **Plummer-D'Amato P**, Altmann LJP. Relationships between motor function and gait-related dual-task interference after stroke: a pilot study. *Gait & Posture.* 2012;35:170-172.
28. **Plummer-D'Amato P**, Brancato B, Dantowitz M, Birken S, Bonke S, Furey E. Effects of gait and cognitive task difficulty on cognitive-motor interference in aging. *Journal of Aging Research* 2012, Article ID 583894, 8 pages. doi:10.1155/2012/583894.

29. **Plummer-D'Amato P**, Cohen Z, Daege NA, Lawson SE, Lizotte MR, Padilla A. Effects of once weekly dual-task training in older adults: a pilot randomized controlled trial. *Geriatrics and Gerontology International*. 2012;12:622–629.
30. **Plummer-D'Amato P**, Kyvelidou A, Sternad D, Najafi B, Villalobos RM, Zurakowski D. Training dual-task walking in community-dwelling adults within 1 year of stroke: A protocol for a single-blind randomized controlled trial. *BMC Neurology*. 2012;12:129.
31. **Plummer-D'Amato P**, Shea G, Dowd C. Motor versus cognitive dual-task effects on obstacle negotiation in older adults. *International Journal of Therapy and Rehabilitation*. 2012;19(4):200-207.
32. Reme SE, **Dennerlein JT**, Hashimoto D, Sorensen G. Musculoskeletal Pain and Psychological Distress in Hospital Patient Care Workers. *Journal of Occupational Rehabilitation*. [Epub ahead of print] PMID: 22466375
33. **Seitz AL**, Michener LA, McClure PW, Finucane S, Ketchum JM, Walsworth MK, Boardman ND. The Scapular Assistance Test Results in Changes in Scapular Position and Subacromial Space but not Rotator Cuff Strength in Subacromial Impingement. *Journal of Orthopaedic and Sports Physical Therapy*. 2012; 42(5):400-12. PMID: 22333409. *Impact Factor= 3.000*
34. **Seitz AL**, Michener LA, McClure PW, Lynch SS, McKinney JL. Effects of Scapular Dyskinesia and Scapular Assistance Test on Subacromial Space during Static Arm Elevation. *Journal of Shoulder and Elbow Surgery*. 2012; 21(5):631-40. PMID: 21444218. *Impact Factor= 2.818*
35. **Seitz AL**, Reinold, MM, Schneider, RA, Gill, TJ, Thigpen, CA. No Effect of Scapular Position on 3-Dimensional Scapular Motion in the Throwing Shoulder of Healthy Professional Baseball Pitchers. *Journal of Sport Rehabilitation*. 2012; 21:186-93. PMID: 22104491 *Impact Factor= 1.072*
36. **Seitz AL**, Uhl TL. Reliability and Minimal Detectable Change in Scapulothoracic Neuromuscular Activity. *Journal of Electromyography and Kinesiology*. 2012;22:968-74. PMID:22683057. *Impact Factor= 2.269*
37. Solomon DH, **Iversen, MD**, Avorn J, Gleeson T, Brookhart MA, Patrick A, Rekedal L, Shrank W, Lii J, Losina E, Katz JN. Osteoporosis telephonic intervention to improve medication adherence: a large pragmatic randomized controlled trial. *Archives Int Med*, 2012, doi:10.1001/archinternmed.2011.1977.
38. Sparer E, **Dennerlein JT**. Determining Safety Inspection Thresholds for Employee Incentives Programs on Construction Sites. *Safety Science*. 2013; 51:77–84.
39. Tanaka, T., Aria, H., Sugihara, S., Ito, R., Izumi, T., **Holden, M.K.** (2012). A study of upper extremity training using a virtual environment system as a computer therapy. Accepted for Publication, *Journal of Physical Therapy Science*.
40. Timmons MK, Thigpen CA, **Seitz AL**, Karduna A, Michener LA. Scapular Kinematics and Shoulder Impingement Syndrome: A Meta-Analysis. *Journal of Sport Rehabilitation*. 2012;21(4):354-70. PMID:22388171 *Impact Factor= 1.072*
41. Trudeau M, Udtamadilok T, Karlson AK, **Dennerlein JT**. Thumb Motor Performance Varies by Movement Orientation, Direction, and Device Size during Single-Handed Mobile Phone Use. *Human Factors*, 2012; 54(1): 51-59. PMID: 22409102
42. Wu M, Landry J, Schmit B, Hornby G, **Yen SC**. Robotic resistance treadmill training improves locomotor function in human SCI: a pilot study. *Archives of Physical Medicine and Rehabilitation* 2012; 93(5): 782-789. (HIGHLIGHT)
43. Xu X, Chang CC, Faber GS, Kingma I, **Dennerlein JT**. Estimating 3-D L5/S1 moments during manual lifting using a video coding system: validity and interrater reliability. *Hum Factors*. Dec 2012;54(6):1053-1065. PMID: 23397813

44. **Yen SC**, Schmit B, Landry J, Roth H, Wu M. Controlled resistance load treadmill training improves overground walking in human with spinal cord injury. *Experimental Brain Research* 2012;216, 473-482. (HIGHLIGHT)
45. **Yen, SC**, Gutierrez, MG, Ling W., Magill R, & McDonough A. Coordination variability during load carriage walking: can it contribute to low back pain? *Human Movement Science* 2012; 31(5): 1286-1301.
46. Young JG, Trudeau M, Odell D, Marinelli K, **Dennerlein JT**. Touch-screen tablet user configurations and case-supported tilt affect head and neck flexion angles. *Work: A Journal of Prevention, Assessment and Rehabilitation*. 2012: 41(1):81-91. PMID: 22246308

Peer Reviewed Conference Abstracts, Presentations and Papers

1. Arias OE, Umukoro PE, Stoffel S, **Dennerlein JT**, Sorensen G. Association between Trunk Flexion and Physical Activity in Patient Care Unit Workers. *Proc. Of the 56th Annual Meeting of the Human Factors and Ergonomics Society*, Boston MA, 2012.
2. Benya K, Heidebrink L, Whitney S, **Seitz AL**. In-Vivo Scapular Muscle Morphology in Individuals with Scapular Dyskinesia: American Physical Therapy Association of Massachusetts 2012 Annual Meeting. Springfield, MA. November 5, 2012
3. Bruno-Garza JL, Eijkelof BH, Huysmans MA, Johnson PJ, van Dieen JH, van der Beek AJ, **Dennerlein JT**. The Effects of Psychosocial Factors on Trapezius Muscle Activity Levels during Computer Use. *Proc. Of the 56th Annual Meeting of the Human Factors and Ergonomics Society*, Boston MA, 2012
4. **Dennerlein, JT**, Arias OE, Umukoro PE, Stoffel S, Sorensen G. Physically demanding work and physical activity in health care workers: Developing key messages for integrated interventions. Proceedings of the American Public Health Association Annual Meeting, San Francisco 2012.
5. Esbjörnsson AC, Rozumalsko A, **Iversen MD**, Schwartz M, Wretenberg P, Brostrom W. Quantifying Gait Deviated in Patients with Rheumatoid Arthritis Using the Gait Deviation Index. ESMAC. Stockholm Sweden Sept 15, 2012
6. Ferris CF, Johnson M, **Sikes RW**, Stolberg T, Prendergast R, Nedelman M, Paskavitz J. 2012, Neural circuits involved in capsaicin-induced pain in awake rats: Imaging temporal changes in activation and deactivation, *Soc for Neurosci Abstr*.
7. **Flores AM**, Nelson J, McCarthy M, Bienenstock K, Caravana C, McCarthy S, Smith B, Blot WJ. Late effects after breast cancer among low income women in the southern United States. 6th Biennial Cancer Survivorship Research Conference, "Cancer Survivorship Research: Translating Science to Care," NCI/CDC/ACS/LiveStrong. Arlington, VA, June 14-16, 2012.
8. Greenwood K, Nicoloso D, **Iversen MD**. An Objective Measurement of Student's Preparedness for Acute Care Clinical Experiences. APTA of Massachusetts, Annual Meeting, Norwood, MA, November 2, 2012
9. **Hasson CJ** and Sternad D (2012). Safety Margins and Variability in a Redundant Object Manipulation Task. Neural Control of Movement 22nd Annual Conference, Venice, Italy, April 23-29.

10. **Hasson CJ** and Sternad D (2012). Variability, safety margins, and redundancy in a timing task. New England Sequencing and Timing Annual Meeting, Amherst, MA.
11. **Hasson CJ**, Abe MO, Sternad D (2012). How does error amplification improve task performance? Satellite Workshop on Computational Neuroscience, Society for Neuroscience 42nd Annual Meeting, New Orleans, LA, October 13-17.
12. **Hasson CJ**, Nasserolelami B, Krakauer, JW and Sternad D (2012). Comparing haptic and visual feedback control of an object with complex dynamics. Society for Neuroscience 42nd Annual Meeting, New Orleans, LA, October 13-17 [Abstract No. 581.10].
13. **Hayward LM**, Charrette AL, Li Li. Global Collaboration for Best Practice: An Inter-Professional Service Delivery Model for the Treatment of Children with Burns Living in China. APTA Combined Sections Meeting. Chicago, Ill, February, 2012.
14. **Hayward LM**. International Community Engagement: Connection to Self, Place and Profession. International Association for Research on Service Learning and Community Engagement Annual Conference. Baltimore, MD. September, 2012.
15. **Holden MK**, Corsino J, Miller B, Delfanti M, Mavroidis C. (2012). Development and testing of 8 balance and pre-gait activity games for the Northeastern University Virtual Ankle and Balance Trainer (NUVABAT). Presentation at Annual Conference and Exposition of the American Physical Therapy Association, June 6-9, Tampa, FL
16. **Holden, M.K.**, Corsino*, J., Miller**, B., Delfanti*, M., Mavroidis, C. (2012). Development and testing of 8 balance and pre-gait activity games for the Northeastern University Virtual Ankle and Balance Trainer (NUVABAT). *Physical Therapy*. May 2012; 92(5): Abstract #2293-RR. Available online at: <http://ptjournal.apta.org/site/misc/annualcon.xhtml> Accessed May 17, 2012.
17. **Iversen MD** Longitudinal Examination of the Impact of Disease Activity on Physical Activity Participation in Rheumatoid Arthritis. APTA Annual Conference and Exposition. Tampa, FL. June 8th, 2012.
18. **Iversen MD**, Quinn T, Frits M. Validity of the Nurses Healthy Study II Physical Activity Questionnaire (NHSPAQ) in Estimating Daily Activity in Persons with Rheumatoid Arthritis (RA). The Annual Meeting of the American College of Rheumatology, Washington DC, November 11, 2012
19. **Iversen MD**. A Rich Description of Clinical Exam Features in Patients with Knee Osteoarthritis and Their Correlation with Functional Outcomes. The Annual Meeting of the American College of Rheumatology, Washington DC, November 10, 2012
20. Jean RA, Jones J, **Seitz AL**. The Reliability of Rehabilitative Ultrasound Imaging to Assess Scapular Muscle Thickness in Individuals with Scapular Dyskinesis. American Physical Therapy Association of Massachusetts 2012 Annual Meeting. Springfield, MA. November 5, 2012
21. Judd J, Gorini N, Smith T, Stone R, **Seitz AL**. Variability of Scapular Motion in Overhead Athletes with Dyskinesis: A Pilot Study. American Physical Therapy Association of Massachusetts 2012 Annual Meeting. Springfield, MA. November 5, 2012
22. Kyvelidou A, Villalobos R, Sternad D, **Plummer-D'Amato P**. Effect of dual-task gait training on obstacle negotiation after stroke: a case study. *Archives of Physical Medicine and Rehabilitation*. 2012;9(10):e34.

23. Nasserolelami B, **Hasson CJ**, and Sternad D (2012). Dynamic predictability in the manipulation of complex objects. Society for Neuroscience 42nd Annual Meeting, New Orleans, LA, October 13-17 [Abstract No. 791.21].
24. Osterman K, Eilert D, Gorgol L, Robart J, **Iversen MD**. Comparison of physical activity levels in patients with rheumatoid arthritis (RA) and age and gender matched healthy controls. APTA of Massachusetts, Annual Meeting, Norwood, MA, November 2, 2012
25. Phillips BJ, Gaunt BW, McCluskey GM, **Seitz AL**. Does the use of a shoulder continuous passive motion device improve range of motion, level of pain, and self-report of function in the early stage of rehabilitation following rotator cuff repair? *Research platform presented at the American Society of Shoulder and Elbow Therapists Annual Meeting*. Sea Island, GA. October 13, 2012.
26. Phillips BJ, Gaunt BW, McCluskey GM, **Seitz AL**. Early Clinical Results of the Kinex KS2 Shoulder CPM to Improve ROM after Rotator Cuff Repair. *Research platform presented at Shoulder Rehabilitation: State of the Art 2012*. Columbus, GA. August 11-12
27. **Plummer-D'Amato P**, Dowd C, Kinnard K, Villalobos R. Environmental setting influences attention allocation ability during dual-task walking after stroke: a case study. *Archives of Physical Medicine and Rehabilitation*. 2012;93(10):e37.
28. **Seitz AL**, Kocher JH, Uhl TL. Scapulothoracic Neuromuscular Adaptations Following A Daily Scapular Strengthening Exercise in Individuals With Shoulder Pain. Research Platform Presentation at the Combined Sections Meeting, American Physical Therapy Association. Chicago, IL. February 11, 2012
29. **Seitz AL**, Roy JS, Ginn K. Shoulder Impingement: From Muscle to Brain. *Conference Proceedings (Focused Symposia) at the International Federation of Orthopaedic Manipulative Physical Therapists Meeting*. Quebec City, Canada. October 2, 2012
30. **Seitz AL**, Uhl TL. Assessing Minimal Detectable Change in Scapulothoracic Neuromuscular Activity. Poster Presentation at the Combined Sections Meeting, American Physical Therapy Association. Chicago, IL. February 9, 2012
31. **Seitz AL**. Scapular neuromuscular adaptations with exercise in individuals with shoulder pain. 15th Annual Shoulder Center of Kentucky Shoulder Symposium. Lexington, KY. July 27-28, 2012
32. Sivak*, M., Murray**, D., Dick*, L., Mavroidis, C., **Holden, M.K.** (2012). Development of a low-cost virtual reality-based Smart Glove for rehabilitation. Proceedings of the 9th International Conference on Disability, Virtual Reality and Associated Technologies, Sept 2012; ISBN 978-0-7049-1545-9.
33. Sparer E, Lowe K, **Dennerlein JT**. A method to capture survey data from construction workers pre- and post-exposure to a worksite intervention. Proceedings of the American Public Health Association Annual Meeting, San Francisco, 2012.
34. Sternad D, Abe MO, and **Hasson CJ** (2012). Deterministic and stochastic error amplification and skilled performance. Society for Neuroscience 42nd Annual Meeting, New Orleans, LA, October 13-17 [Abstract No. 88.18].
35. Trudeau MB, Young JG, Jindrlich DJ, **Dennerlein JT**. Thumb Motor Performance Is Greater for Two-Handed Grip Compared to Single-Handed Grip on a Mobile Phone. *Proc. Of the 56th Annual Meeting of the Human Factors and Ergonomics Society*, Boston MA, 2012.

36. Wu, M, MacDonald J, **Yen SC**, Chen, D, Kim J, Improved walking in human with spinal cord injury through one session of 3D cable-driven robotic treadmill training. Biomedical Engineering Society Annual Meeting. Atlanta GA. October 24-27, 2012.
37. **Yen SC**, Schmit B, MacDonald J, Kim J, Wu, M. Controlled resistance load treadmill training improves overground walking in human post stroke. Neuroscience 2012. New Orleans CA. October 13-17, 2012.

Grants Submitted (\$6.7 million)**2012 External Funding: Total \$6,637,881 (\$5,752,587 with faculty as PI or Co-PI)**

Agency	Title	Direct Costs	Faculty	Status
National Institute for Occupational Safety and Health	Randomized Controlled Trial of Whole Body Vibration Intervention in Truck Driver	\$1,396,817	Dennerlein (PI)	Pending
HSPH Center for Work, Health and Well being	'Standing Up' Against Sedentary Behavior: A Pilot Study in Office Workers	\$17,149	Dennerlein (PI)	Funded
HSPH Center for Work, Health and Well being	'The Emerald Small Business Model Health and Wellness Program Pilot Aimed to disseminate integrated worker health programs among small/medium employer	\$15,190	Dennerlein (PI) Markowski (Co-PI)	Not Funded
APTA Section on Women's Health	Moving On: A pilot test for acceptability and feasibility of an early physical therapy education intervention for breast cancer survivors	\$5,000	Flores (PI)	Funded
American Federation for Aging Research	Virtual Aging: An Original Approach to Understanding How Altered Muscle Dynamics Affects Movement Control in Older Adults	\$92,539	Hasson (PI)	Pending
National Science Foundation	Robotic Reinforcement: A New Approach for Robotic Gait Rehabilitation after Stroke	\$1,070,362	Hasson (PI) Yen (Co-PI)	Pending
The Village Church Outreach grants program	Connection of People, Place and Profession	\$2,530	Hayward	Funded
Patient Centered Outcomes Research Institute	Triggering Options for Urban Communities with Hypertension	\$1,065,801	Hayward (Co-PI)	Pending
National Science Foundation	A Smart Patient –centered rehabilitation system to promote physical activity and enhance physical therapy for rheumatoid arthritis (RPLAY)	\$744,124	Iversen (PI)	Pending
National Institutes of Health (R21)	Real-world assessment of dual-task performance after stroke	\$439,415	Plummer-D'Amato	Not Funded

American Physical Therapy Association Orthopaedic Section Foundation Grant	Effectiveness of a rehabilitation program emphasizing motor control for individuals with rotator cuff tendinopathy: a randomized clinical trial	\$15,000	Seitz (PI)	Not Funded
National Science Foundation (PI Erdogmus)	Noninvasive Brain Controlled Hand Prosthetics – Optimal Shared Control through Modeling of Motor Learning	\$888,660	Yen (Co-PI)	Pending
National Science Foundation (PI Mavroidis)	Virtual Reality Augmented Ankle and Balance Trainer	\$381,915	Holden (Co-I)	Pending
National Science Foundation (PI Mavroidis)	Ankle and Balance Robotic Trainer Augmented With Interactive Gaming	\$241,644	Holden (Co-I)	Pending
National Institute of Arthritis and Musculoskeletal and Skin Diseases (R21)	Study of Physical Activity Rewards after Knee Surgery	\$150,000	Iversen (Co-I)	Pending
Pediatric Orthopedic Society of North America	Development of a pediatric version of Marx Activity Scale	\$9,000	Iversen (Co-I)	Pending
Canadian Institutes of Health Research Grant (PI- JS Roy)	Predicting the outcome of rehabilitation in individuals with rotator cuff tendinopathy	\$102,735	Seitz (Co-I)	Not Funded

Internal Funding: Total Submitted \$154,413

Agency	Title	Direct Costs	Faculty	Status
Northeastern University Tier 1 Seed Grant	A Low-Cost Virtual Reality-based Smart Glove for Rehabilitation	\$50,000	Holden (PI)	Not funded
Northeastern University Tier 1 Grants	Talking and walking: Interactions between cognitive-linguistic, respiratory, and postural demands after stroke	\$50,000	Plummer-D'Amato	Not Funded
Northeastern University Tier 1 Grants	Boston Puerto Rican Cancer Survivorship Stud	\$50,000	Flores (PI)	Funded
Northeastern University Provost CIETL Research Funds	Assessment within Physical Therapy, Innovative Educational Strategies	\$4,135	Hayward (PI)	Funded

Funded Grants (\$685,695 in direct costs in 2012)**2012 External Funding: Total direct costs for 2012 \$606,848
(Listing only grants amounts to Northeastern University)**

Agency	Title	Direct Costs	Faculty
National Institute for Occupational Safety and Health	HSPH Center for Excellence to Promote a Healthier Workforce	\$147,012	Dennerlein (PI)
National Institute for Occupational Safety and Health	Center for Construction Research and Training: Effectiveness of employee safety incentive programs in construction	\$124,262	Dennerlein (PI)
University of Washington & State of Washington Safety Health Investment Projects	Randomized Controlled Trial of a Whole Body Vibration Intervention in Truck Drivers	\$22,569	Dennerlein (PI)
APTA Section on Women's Health	Moving On: A pilot test for acceptability and feasibility of an early physical therapy education intervention for breast cancer survivors	\$5,000	Flores (PI)
The Village Church Outreach grants program	Connection of People, Place and Profession	\$2,530	Hayward (PI)
Kenneth B. Schwartz Center Fund of Massachusetts General Hospital (MGH).	Creating a Culturally Competent and Inter-professional Aware Health Care Environment within the Spaulding Rehabilitation Hospital.	\$10,100	Hayward (PI)
National Institutes of Health R21	Southern Community Cancer Survivorship Study.	\$80,000	Flores (PI)
National Institute of Arthritis and Musculoskeletal and Skin Diseases	Tai Chi and Knee Osteoarthritis	\$60,000	Iversen (PI)
American Heart Association: Scientist Development Grant	Training dual task walking after stroke: effects on attentional and locomotor control	\$70,000	Plummer-D'Amato
The Shapiro Family Foundation	Advancement of the MassMATCH Assistive Technology School Swap Program	\$12,000	Ventura

Agency	Title	Direct Costs	Faculty
National Institute of Arthritis and Musculoskeletal and Skin Diseases (R21)	Randomized Controlled Trial to Improve Adherence with Osteoporosis Care	\$73,375	Iversen (Co-I)

Internal Funding: Total (\$78,847)

Agency	Title	Direct Costs	Faculty
Northeastern University Tier 1 Grants	Boston Puerto Rican Cancer Survivorship Study	\$50,000	Flores (PI)
Northeastern University Provost CIETL Research Funds	Assessment within Physical Therapy, Innovative Educational Strategies	\$4,135	Hayward (PI)
Northeastern University Undergraduate Research	22 Different research projects involving undergraduates students involvement in research	\$24,712	11 Faculty Members