

## **THAD W. BUSTER, M.S.**

**Email:** tbuster@madonna.org

**Phone:** 402.413.4508

### **Office:**

Richard W. and Jacqueline B. Chapin Gait & Motion Lab

### **Mailing Address:**

Institute for Rehabilitation Science and Engineering  
Madonna Rehabilitation Hospital  
5401 South Street  
Lincoln, NE 68506

### **Education**

M.S. Exercise Science (2010). University of Nebraska-Omaha, Omaha, NE

B.S. Exercise Science (1998). Wayne State College, Wayne, NE

### **Patents**

Burnfield JM, Shu Y, Taylor AP, Buster TW, Nelson CA (2011). Rehabilitation and Exercise Machine. U.S. Patent 8,007,405.

Burnfield JM, Shu Y, Taylor AP, Buster TW, Nelson CA (2012). Rehabilitation and Exercise Machine. U.S. Patent 8,177,688 B2.

Burnfield JM, Taylor AP, Buster TW, Nelson CA, Shu Y (2014). Improved Rehabilitation and Exercise Machine. Canadian Patent 2,776,626.

## **SELECTED ARTICLES**

Cesar GM, Buster TW, Burnfield JM. Cardiorespiratory fitness, balance, and walking improvements in an adolescent with cerebral palsy (GMFCS II) and autism after motor-assisted elliptical training. *European Journal of Physiotherapy*. Accepted for publication.

Burnfield JM, Buster TW, Pfeifer CM, Irons SL, Cesar GM, Nelson CA (2018). Adapted motor-assisted elliptical for rehabilitation of children with physical disabilities. *ASME Journal of Medical Devices*, published online ahead of print, September 26, 2018. DOI: 10.1115/1.4041588.

Pfeifer CM, Rowan D, Buster TW, Cesar GM, Irons SL, Burnfield JM (2018). Design and validation of a heart rate and speed monitoring device with Intelligently Controlled Assistive Rehabilitation Elliptical. *ASME Journal of Medical Devices*, published online ahead of print, August 29, 2018. DOI: 10.1115/1.4041337.

Williams NA, Burnfield JM. Psychological difficulties and parental well-being in children with musculoskeletal problems in the 2011/2012 National Survey of Children's Health. Accepted, *Rehabilitation Psychology*.

Burnfield JM, Cesar GM, Buster TW, Irons SL, Pfeifer CM (2018). Walking and fitness improvements in child with diplegic cerebral palsy following motor-assisted elliptical intervention. *Pediatric Physical Therapy*, 30(4):E1-E7. DOI: 10.1097/PEP.0000000000000541.

Burnfield JM, Pfeifer CM, Kwapiszeski S, Irons SL, Buster TW, Cesar GM (2018). Impact of ICARE training speed and motor assistance on cardiovascular response. *Cardiopulmonary Physical Therapy Journal*, published online

ahead of print, September 10, 2018. DOI: 10.1097/CPT.0000000000000098.

Cesar GM, Buster TW, Burnfield JM (2017). Should gait outcomes be the primary focus in pediatric gait rehabilitation? *Journal of Novel Physiotherapies*, 7(3):1000342. DOI: 10.4172/2165-7025.1000342

Burnfield JM, Cesar G, Buster TW, Irons SL, Nelson CA (2017). Kinematic and muscle demand similarities between motor-assisted elliptical training and walking: Implications for pediatric gait rehabilitation. *Gait & Posture*, 51:194-200. DOI: 10.1016/j.gaitpost.2016.10.018.

Burnfield JM, Buster TW, Goldman AJ, Corbridge LM, Hanigan K (2016). Partial body weight support treadmill training speed influences paretic and non-paretic muscle activation and stride characteristics during acute stroke rehabilitation. *Human Movement Science*. (47): 16-28. DOI: 10.1016/j.humov.2016.01.012

Buster TW, Chernyavskiy P, Harms NR, Kaste G, Burnfield JM (2016). Assessment of balance using computerized dynamic posturography in individuals with and without chronic severe traumatic brain injury. *Brain Injury*. 30(10):1249-1255. DOI: 10.1080/02699052.2016.1183822.

Irons SL, Brusola GA, Buster TW, Burnfield JM (2015). Novel ICARE Intervention Improves Six-Minute Walk Test and Oxygen Cost for an Individual with Progressive Supranuclear Palsy. *Cardiopulmonary Physical Therapy Journal*, 26(2):36-41. DOI: 10.1097/CPT.0000000000000007

Nelson CA, Stolle CJ, Burnfield JM, Buster TW (2015). Modification of the Intelligently Controlled Assistive Rehabilitation Elliptical (ICARE) system for pediatric therapy. Published online, *ASME Journal of Medical Devices*, 9(4): 6 pages. DOI: 10.1115/1.4030276.

Burnfield JM, Irons SL, Buster TW, Taylor AP, Hildner GA, Shu Y (2014). Comparative analysis of speed's impact on muscle demands during partial body weight support motor-assisted elliptical training, *Gait & Posture*. 39(1): 314-320. DOI: <http://dx.doi.org/10.1016/j.gaitpost.2013.07.120>

Burnfield JM, McCrory B, Shu Y, Buster TW, Taylor AP, Goldman AJ (2013). Comparative kinematic and electromyographic assessment of clinician- and device-assisted sit-to-stand transfers in patients with stroke. *Physical Therapy*, 93(10):1331-1341. DOI: 10.2522/ptj.20120500

Buster TW, Burnfield JM, Taylor AP, Stergiou, N (2013). Lower extremity kinematics during walking and elliptical training in individuals with and without traumatic brain injury. *Journal of Neurologic Physical Therapy*. 37(4): 176-186. DOI: 10.1097/NPT.0000000000000022

Burnfield JM, Shu Y, Buster TW, Taylor A, McBride MM, Krause ME (2012). Kinematic and electromyographic analysis of normal and device-assisted sit to stand transfers. *Gait and Posture*, 36(3):516-522. DOI: <http://dx.doi.org/10.1016/j.gaitpost.2012.05.002>

Burnfield JM, Shu Y, Buster TW, Taylor A, Nelson CA (2011). Impact of elliptical trainer ergonomic modifications on perceptions of safety, comfort, workout and usability by individuals with physical disabilities and chronic conditions. *Physical Therapy*, 91(11):1604-1617. DOI:<https://doi.org/10.2522/ptj.20100332>

Nelson CA, Burnfield JM, Shu Y, Buster TW, Taylor A, Graham A (2011). Modified elliptical machine motor-drive design for assistive gait rehabilitation. *Transactions of the ASME Journal of Medical Devices*, 5:021001.1-021001.7. DOI:10.1115/1.4003693

Burnfield JM, Shu Y, Buster TW, Taylor A (2010). Similarity of joint kinematics and muscle demands between elliptical training and walking: Implications for practice. *Physical Therapy*. 90(2). 289-305. DOI:<https://doi.org/10.2522/ptj.20090033>

## SELECTED ABSTRACTS

Pfeifer CM, Whorley BA, Buster TW, Cesar GM, Burnfield JM (2018). Investigation of center of pressure during gait and motor-assisted elliptical training in adults. *Archives of Physical Medicine and Rehabilitation*, 99(12):e206. DOI: <https://doi.org/10.1016/j.apmr.2018.09.052>.

Burnfield JM, Cesar GM, Buster TW, Pfeifer CM, Anglehart CM, Klem CJ, Dasgupta P, Nelson CA (2018). Perceived value of modular self-reconfigurable robot for reaching/retrieving by individuals with SCI. *Archives of Physical Medicine and Rehabilitation*, 99(12):e209-210. DOI: <https://doi.org/10.1016/j.apmr.2018.09.063>.

Huang C-K, Buster TW, Siu K-C, Burnfield JM (2018). Combining virtual reality gaming with motor-assisted elliptical impacts children's engagement in exercise. *Archives of Physical Medicine and Rehabilitation*, 99(12):e195. DOI: <https://doi.org/10.1016/j.apmr.2018.09.020>.

Cesar GM, Irons SL, Garbin A, Eckels E, Buster TW, Burnfield JM (2017). Child with traumatic brain injury improved gait abilities following intervention with pediatric motor-assisted elliptical training: A case report. *Journal of Neurologic Physical Therapy*, 41(1):84. DOI: <https://doi.org/10.1097/NPT.0000000000000156>.

Irons SL, Burnfield JM, Buster TW, Karkowski-Schelar E, Johns E (2016). Individuals with multiple sclerosis improved walking endurance and decreased fatigue following motor-assisted elliptical training intervention. *Archives of Physical Medicine and Rehabilitation*, 97(10):e34. DOI: <http://dx.doi.org/10.1016/j.apmr.2016.08.100>

Burnfield JM, Buster TW, Irons SL, Cesar GM, Nelson CA, Rech NR, Nichols EM (2016). Pediatric walking vs. training on prototype motor-assisted elliptical: Kinematic comparison at self-selected comfortable speed. *Archives of Physical Medicine and Rehabilitation*, 97(10):e99. DOI: <http://dx.doi.org/10.1016/j.apmr.2016.08.306>

Burnfield JM, Irons SL, Cesar GM, Buster TW, Khot R, Nelson CA (2016). Pedi-ICARE training improves walking and endurance of child with cerebral palsy. *Archives of Physical Medicine and Rehabilitation*, 97(12):e19-e20. DOI: <http://dx.doi.org/10.1016/j.apmr.2016.09.053>

Burnfield JM, Buster TW, Irons SL, Rech N, Cesar GM, Pfeifer CM, Nelson CA (2016). Pediatric Intelligently Controlled Assistive Rehabilitation Elliptical for Walking and Fitness: Prototype Development and Biomedical Analysis [Abstract]. RESNA/NCART (Rehabilitation Engineering Society of North America/National Coalition for Assistive and Rehab Technology) 2016 annual convention, July 10-14, Arlington, VA.

Pfeifer CM, Burnfield JM, Kota S, Buster TW, Irons SL, Rowen DA, Nelson CA (2016). Positive Reinforcement System Design for Therapeutic Devices [Abstract]. RESNA/NCART (Rehabilitation Engineering Society of North America/National Coalition for Assistive and Rehab Technology) 2016 annual convention, July 10-14, Arlington, VA.

Pfeifer CM, Burnfield JM, Kota S, Buster TW, Irons SL, Sulski C, Nelson CA (2016). Design of a Custom Heart-Rate Control System for the Pediatric Intelligently Controlled Assistive Rehabilitation Elliptical [Abstract]. RESNA/NCART (Rehabilitation Engineering Society of North America/National Coalition for Assistive and Rehab Technology) 2016 annual convention, July 10-14, Arlington, VA.

Buster TW, Burnfield JM, Irons SL, Nelson CA, Trejo LH, Leutzinger TJ (2016). Pediatric walking vs. training on a prototype motor-assisted elliptical: kinematic and EMG comparisons at self-selected fast speeds [Abstract]. Conference proceedings, 2016 Annual Meeting Gait and Clinical Movement Analysis Society. Memphis, TN, May 17-20, 2016.

Burnfield JM, Irons SL, Buster TW (2016). Individual with progressive supranuclear palsy demonstrates improvements in walking distance and efficiency following a motor-assisted elliptical training intervention [Abstract]. Conference proceedings, 9th World Congress for Neurorehabilitation. Philadelphia, PA, May 12, 2016.

Burnfield JM, Buster TW, Irons SL (2016). Individuals post stroke improved walking endurance and efficiency

following motor-assisted elliptical training intervention [Abstract]. Conference proceedings, 9th World Congress for Neurorehabilitation. Philadelphia, PA, May 12, 2016.

Buster TW, Burnfield JM (2016). Movement variability during walking and elliptical exercise for individuals with chronic severe traumatic brain injuries [Abstract]. Conference proceedings, 9th World Congress for Neurorehabilitation. Philadelphia, PA, May 12, 2016.

Nelson CA, Stolle CJ, Burnfield JM, Buster TW (2015). Synthesis of a rehabilitation mechanism replicating normal gait [Technical Paper]. Conference Proceedings, 14th World Congress in Mechanisms and Machine Science; DOI: 10.6567/IFTtoMM.14TH.WC.OS1.016. Taipei, Taiwan, October 25-30, 2015.

Trejo LH, Buster TW, Stolle CJ, Nelson CA, Burnfield JM (2014). Influence of rocker and crank arm lengths on Intelligently Controlled Assistive Rehabilitation Elliptical (ICARE) coupler trajectories. Proceedings, Midwest BME Career Conference. p. 31

Burnfield JM, Nelson CA, Buster TW, Taylor AP (2012). Affordable technology addresses walking and fitness deficits across rehabilitation continuum of care. 10th Annual Conference of the American Medical Rehabilitation Providers Association. San Diego, CA.

Watt BP, Burnfield JM, Truemper EJ, Buster TW, Bashford GR (2012). Monitoring cerebral hemodynamics with transcranial doppler ultrasound during cognitive and exercise testing in adults following unilateral stroke. 34th Annual International IEEE Engineering in Medicine and Biology Conference. San Diego, CA.

Yeseta MC, Taylor AP, Buster TW, Shu Y, Burnfield JM (2012). Exercise endurance and functional mobility improve for individuals with physical disabilities after training on a motorized elliptical. Online proceedings, Rehabilitation Engineering and Assistive Technology Society of North America's 2012 Annual Conference.

Burnfield JM, Yeseta M, Buster TW, Taylor AP, Shu Y (2012). Individuals with physical limitations can benefit from training on a motorized elliptical for community-based exercise. *Medicine and Science in Sports and Exercise*, 45(5 Supplement), pg. S360.

Taylor AP, Lowndes BR, Buster TW, Shu Y, Burnfield JM (2012). Speed's impact on pedar pressures at varying levels of body weight supported ICARE training. Proceedings, Gait and Clinical Movement Analysis Society 2012 Annual Meeting, pgs. 139-140.

Shu Y, Taylor AP, Buster TW, Burnfield JM (2012). Clinicians' motion and muscle activation patterns during body weight support treadmill training. Proceedings, Gait and Clinical Movement Analysis Society 2012 Annual Meeting, pgs. 230-231.

Buster TW, Goulet C, Shafer D, Burnfield JM (2012). Comparison of kinematic demands of walking and elliptical training between individuals with and without mild to moderate multiple sclerosis. Proceedings, Gait and Clinical Movement Analysis Society 2012 Annual Meeting, pgs. 232-233.

Burnfield JM, Hildner GA, Buster TW, Taylor AP, Shu Y (2011). Speed's impact on muscle demands during partial body weight supported training on a motorized elliptical. *Archives of Physical Medicine and Rehabilitation*, 92(10): 1700. DOI: <http://dx.doi.org/10.1016/j.apmr.2011.07.045>

Burnfield JM, Taylor AP, Buster TW, Shu Y, Goldman AJ, Nelson CA (2011). Use of Intelligently Controlled Assistive Rehabilitation Elliptical Trainer to Improve Walking and Fitness during Acute Stroke Rehabilitation. *Stroke*, 42(3), pg. e326.

Goldman AJ, Buster TW, Taylor AP, Ediger MJ, Shu Y, Burnfield JM (2011). Muscle Demands of Device Assisted versus Clinician Assisted Sit-to-stand Transfers: Implications for Stroke Rehabilitation. *Stroke*, 42(3), pgs. e326-327.

Burnfield JM, Goulet C, Buster TW, Cassel AJ, Mills J, Seow CM (2011). Comparison of velocity, muscle demands and perceived exertion during elliptical training and treadmill walking in individuals with and without multiple sclerosis. Annual Combined Sections Meeting of the American Physical Therapy Association.

Burnfield JM, Shu Y, Buster TW, Taylor AP, Merriman L, Nelson CA (2010). Comparison of lower extremity electromyographic (EMG) demands during ICARE training and walking. Online Proceedings, American Society of Biomechanics 34th Annual Meeting, pgs. 334-335.

Buster TW, Taylor AP, Frazier M, Burnfield JM (2010). Kinematic analysis of five cardiovascular exercises. Online Proceedings, American Society of Biomechanics 34th Annual Meeting, pgs. 324-325.

Hueftle AM, Balogh BJ, Taylor AP, Goldman AJ, Buster TW, Burnfield JM (2010). Stroke rehabilitation: A kinematic analysis of device-assisted and clinician-assisted sit-to-stand transfers. Online Proceedings, American Society of Biomechanics 34th Annual Meeting, pgs. 310-311.

Burnfield JM, Buster TW, Taylor A, Keenan S, Shu Y, Nelson CA (2010). Intelligently Controlled Assistive Rehabilitation Elliptical (ICARE) Training: An Analysis of Lower Extremity Electromyographic (EMG) Demands with Varying Levels of Motor Assistance. Online Proceedings, Rehabilitation Engineering and Assistive Technology Society of North America's 2010 Annual Conference.

Shu Y, Buster TW, Taylor A, Keenan S, Nelson CA, Burnfield JM (2010). Ergonomic redesign of elliptical trainer to promote greater safety, comfort and usability. Online Proceedings, Rehabilitation Engineering and Assistive Technology Society of North America's 2010 Annual Conference.

McBride MM, Hueftle AM, Krause ME, Buster TW, Burnfield JM, Bashford GR, Taylor AP. Safe Patient Handling: A Kinematic Analysis of Device-Assisted Versus No Device Sit-to-Stand Motion. Online Proceedings, American Society of Biomechanics 2009 Annual Meeting.

Burnfield JM, Roemmich RT, Scherr T, Buster TW (2009). Comparison of Vastus Lateralis and Medial Hamstring Electromyographic Activity Across Five Cardiovascular Exercises. Supplement to *Medicine and Science in Sports and Exercise*, 41(5), pgs. S568-569.

Buster TW, Roemmich RT, Doherty NJ, Burnfield JM (2009). Comparison of Ankle Muscle Electromyographic Activity Across Five Cardiovascular Exercises. Supplement to *Medicine and Science in Sports and Exercise*, 41(5), pg. S569.

Taylor AP, Buster TW, Barber BR, Burnfield JM (2009). Comparison of Forefoot and Heel Pressures Across Fast Walking and Four Elliptical Trainer Conditions. Supplement to *Medicine and Science in Sports and Exercise*, 41(5), pg. S242.

Corbridge LM, Goldman AJ, Shu Y, Buster TW, Burnfield JM (2009). Clinician's Muscle Effort During Partial Body Weight Support Treadmill Training: Is it Hard Work? Presented, American Physical Therapy Association's 2009 Annual Conference and Exposition.

Goldman AJ, Corbridge LM, Buster TW, Burnfield JM (2009). Partial Body Weight Support Treadmill Training During the Acute Phase of Stroke Recovery: Impact of Training Speed on Non-Hemiparetic Limb Stride Characteristics and Muscle Demands. Presented, American Physical Therapy Association's 2009 Annual Conference and Exposition.

Burnfield JM, Barber BR, Buster TW, Taylor AP (2009). Plantar Pressures Vary Across Elliptical Trainers and Compared to Walking. Proceedings, 2009 Gait and Clinical Movement Analysis Society 14th Annual Meeting.

Buster TW, Goldman AJ, Corbridge LM, Shu Y, Burnfield JM (2009). Partial Body Weight Support Treadmill Training: Clinician's Upper Extremity Muscle Activation During Facilitation of Hemiparetic Limb Movement. Proceed-



ings, 2009 Gait and Clinical Movement Analysis Society 14th Annual Meeting.

Burnfield JM, Corbridge LM, Goldman AJ, Rey ME, Ankeny AJ, Buster TW (2009). Influence of partial body weight support treadmill training walking speed on muscle activation and stride characteristics in adults with acute unilateral stroke. Presented, 2009 Annual Combined Sections Meeting of the American Physical Therapy Association.

Burnfield JM, Buster TW, Provorse A, Takahashi S (2007). Muscular demands during elliptical training compared to overground walking. *Physiotherapy*, 93(Supplement 1):S179.

Takahashi S, Burnfield JM, Buster TW, Provorse AR (2007). Comparison of Gluteal Muscle Electromyographic Activity across Five Cardiovascular Exercises in Healthy Young Adults. *Medicine and Science in Sports and Exercise*, Volume 39:5 S255.

Burnfield JM, Buster TW, Takahashi S (2007). Increased Diabetic Risk for Individuals with Disabilities - A Need for Adaptations and Monitoring. CDC's 30th Diabetes Translation Conference - Looking Back and Moving Forward, Abstract Book.

Buster TW, Ginoza LM, Burnfield JM (2006). Comparison of lower extremity sagittal plane kinematics during overground gait, treadmill walking and elliptical training. *Proceedings CD, American Society of Biomechanics, 30th Annual Meeting*.

Todd JB, Conley DS, Buster TW, Dyrstad SI, Strand JT (2000). Effect of rest interval length on multiple set high intensity bench press performance. *Medicine and Science in Sports and Exercise*, 32(5): S150.

## **INVITED PROFESSIONAL PRESENTATIONS**

Buster TW, Fager S. Maximizing independence for individuals with movement challenges using “smart” technology environmental controls. Madonna Physical Therapy Spotlight on Technology Series. Lincoln, NE. Presented September 16 and 23, 2014.

Buster TW. 3-D Printing-Digital Manufacturing: How can it benefit you as a clinician? Madonna Physical Therapy Spotlight on Technology Series. Lincoln, NE. Presented June 15, 2014.

Buster TW. ICARE Training to Improve Walking and Cardiovascular Fitness for Individuals Living with Parkinson's disease. Lincoln Parkinson's disease Group. Lincoln, NE. Presented Oct 26, 2014.

Buster TW. Rehabilitation Technology to Improve Walking and Cardiovascular Fitness for Individuals Living with Physical Disabilities and Chronic Conditions. Kiwanis Club. Lincoln, NE. Presented May 2, 2014.

Burnfield JM, Buster TW. Development and Implementation of the ICARE for Use in Rehabilitation and Fitness. Hospital Corporation of America. Nashville, TN. Presented October 14, 2013.

Burnfield JM, Buster TW. ICARE Training to Improve Walking and Cardiovascular Fitness for Individuals Living with Physical Disabilities and Chronic Conditions. Quality Living Incorporated. Omaha, NE. Presented April 10, 2013.

Burnfield JM, Buster TW. ICARE Training to Improve Walking and Cardiovascular Fitness for Individuals Living with Physical Disabilities and Chronic Conditions. Hospital for Special Care. New Britain, CT. Presented April 2-3, 2012.

Burnfield JM, Buster TW. ICARE Training to Improve Walking and Cardiovascular Fitness for Individuals Living with Physical Disabilities and Chronic Conditions. JFK Johnson Rehabilitation Institute. Edison, NJ. Presented March 26-27, 2012.

Burnfield JM, Salisbury M, Spellman C, Buster TW. Promoting Optimal Walking and Community Engagement in Those Living with Multiple Sclerosis. Nebraska TREND Symposium 2011. Lincoln, NE. Presented March 12, 2011.

Burnfield JM, Buster TW. Neuroplasticity: Applying Guiding Principles to Help People Relearn to Walk Following an Injury. Osher Lifelong Learning Institute (OLLI), College of Education and Human Sciences, University of Nebraska – Lincoln. Lincoln, NE. April 8, 2009.