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TITLE: Improved Training Program for Fall Prevention of Warfighters with Lower Extremity Trauma

PRINCIPAL INVESTIGATOR: Kenton Kaufman, PhD, PE

CONTRACTING ORGANIZATION: Mayo Clinic, Rochester, MN

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Kenton Kaufman, PhD, PE

e-mail:kaufman.kenton@mayo.edu

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Mayo Clinic
200 First Street SW
Rochester, MN 55905

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
Recent military conflicts have resulted in a significant number of lower extremity injuries to U.S. Service members that result in amputation or limb preservation procedures. Service members with lower extremity trauma are receiving comprehensive care with the overarching goal of achieving the highest level of function and readiness. However, after standard rehabilitation, many warfighters still struggle with falls, which can exacerbate physical and emotional injury and delay healing. The goals of this research effort were to augment existing rehabilitation with a novel, fall-prevention training method to help warfighters return to full high-level functional capabilities and emotional wellness. Forty-five service members (40 males; mean (SD) age: 34 (8) years) with lower limb trauma (20 trans-tibial amputation; 6 transfemoral amputation; 5 bilateral trans-tibial amputation; 14 limb salvage) were recruited. The training program used a microprocessor-controlled treadmill designed to deliver task-specific postural perturbations that simulated a trip. The training consisted of six 30-minute sessions delivered over a two-week period, during which task difficulty, including perturbation magnitude, increased as the participant's ability progressed. Repeated testing prior to training revealed that there were no differences in trunk control prior to training. The training program resulted in improved trunk control. The skills were retained three and six months after training. The entire cohort of participants reported 2 (0-4) falls/month before training. The fall rate decreased to 1 (0-2) fall/month after training ($p=0.11$), and then continued to decrease to 0 (0-2) falls/month at three- and six-months post training ($p=0.02$).

15. SUBJECT TERMS
Amputation, Limb Salvage, Falls, Fall Prevention, Rehabilitation, Therapy

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Table of Contents

1. INTRODUCTION

Recent military conflicts have resulted in a significant number of lower extremity injuries to U.S. Service members that result in amputation or limb preservation procedures. Service members with lower extremity trauma are receiving comprehensive care with the overarching goal of achieving the highest level of function and readiness. Falls and fear of falling are among the key factors that prevent service members with lower extremity trauma from achieving maximal functional capabilities. Despite the high prevalence and deleterious consequences of falls following lower extremity trauma, very little research exists to improve balance and reduce falls, especially among young active populations such as Service members with limb preservation or loss. Our prior work developed an intervention which demonstrated the ability to reduce falls in service members with unilateral trans-tibial amputation through task-specific training. An ongoing effort has been made to expand this fall prevention training program to additional patient populations with diverse types of amputations and limb preservation procedures following lower extremity trauma. We aimed to assess effectiveness of the fall prevention training program by (1) quantifying improvements in trunk control; (2) quantifying fall rates, and (3) demonstrating skill retention at three and six months after training.

2. **KEYWORDS:** Amputation, Transtibial, Transfemoral, Limb Salvage, Fall Risk, Falls, Fall Prevention, Rehabilitation, Therapy

3. ACCOMPLISHMENTS

- **What were the major goals of the project?**

  This project had three main goals.
  (1) Implement a novel postural perturbation training program in the three DOD Medical Treatment facilities. This rehabilitation protocol was provided to service members who have suffered combat-related lower limb trauma, specifically amputations or salvaged limbs.
  (2) Assess whether the benefits of improved motor skills induced by the rehabilitation protocols can be retained following training.
  (3) Identify, evaluate, and implement existing low cost methods for measuring trunk control that can be used in lieu of substantially more expensive fixed motion capture systems. This will ensure that the rehabilitation program can be transitioned to clinical settings.

- **What was accomplished under these goals?**

  Major activities:
  - The fall prevention training program utilizes a microprocessor-controlled treadmill to deliver task specific postural perturbations. Treadmills were installed and custom software created to operate these treadmills at the three Advanced Rehabilitation Centers within the Department of Defense Military Treatment Facilities. A User's Guide was created for the custom software that was developed to provide the perturbations.
  - A simple method was developed and validated to collect trunk kinematics using an inertial measurement unit.
  - Regulatory approval was obtained with NMCSD as the IRB of record for the protocol.
  - Standard operating procedures were created for data collection and analysis.
  - An integrated software platform was created using REDCap for data collection and storage. A status dashboard was implemented to provide quick and easy tracking of project-wide and individual site recruitment and data collection progress. This allowed efficient monitoring to ensure recruitment goals were coordinated and met across multiple data collection sites.

- 319 subjects were screened, 55 subjects were eligible, 45 subjects enrolled, 35 subjects completed the training, and 27 subjects completed the six-month follow-up. The goal for the project was to enroll, train, and test 30 subjects.
- The research effort resulted in 12 abstracts at national and international conferences, 4 published manuscripts, and 6 additional manuscripts submitted or in preparation. One abstract presented at the 12th Annual Joint National Capital Region Research Competition received 2nd place for the Robert A. Phillips Award (top 4 of 209 submissions).

Major findings

- Repeated testing prior to training revealed that there were no differences in trunk control prior to training. Trunk flexion angle was unchanged in the two baseline, pre-training assessments (95% CI: -2°, 7°; p=0.36) with no side-to-side differences (p=0.84). Likewise, trunk flexion velocity was unchanged (95% CI: -14°/sec, 31°/sec; p=0.44) with no side-to-side differences (p=0.95).
- The training program resulted in improved control of perturbation-induced recovery step trunk flexion angle and velocity (Figure 1). The trunk flexion angle improved from pre-training (29°; 95% CI: 26°, 32°) to immediately post-training (21°; 95% CI: 18°, 23°; p < 0.001). Likewise, the trunk flexion velocity improved from pre-training (52°/sec; 95% CI: 36°/sec, 67°/sec) to immediately post-training (23°/sec; 95% CI: 9°/sec, 39°/sec; p=0.03). There were no side-to-side differences in peak trunk flexion angle (p = 0.60) or peak trunk flexion velocity (p = 0.55), nor interactions (p>0.20).
- The skills acquired with the perturbation training were retained three and six months after training (Figure 1). The trunk flexion angle had means of 21° (95% CI: 18°, 23°) at zero months, 18° (95% CI: 16°, 21°) at three months, and 20° (95% CI: 17°, 23°) at six months. Likewise, the trunk flexion velocity had means of 23°/sec (95% CI: 9°/sec, 39°/sec) at zero months, 13°/sec (95% CI, 1°/sec, 26°/sec) at three months, and 17°/sec (95% CI: -2°/sec, 36°/sec) at six months. There were no changes in the peak trunk flexion angle (p = 0.55) or peak trunk flexion velocity (p = 0.53) over time after the training ended. The skill retention was present when either limb was perturbed; there were no side-to-side differences in the trunk flexion angle (p = 0.88) and trunk flexion velocity (p = 0.11) and no interactions (p>0.27).

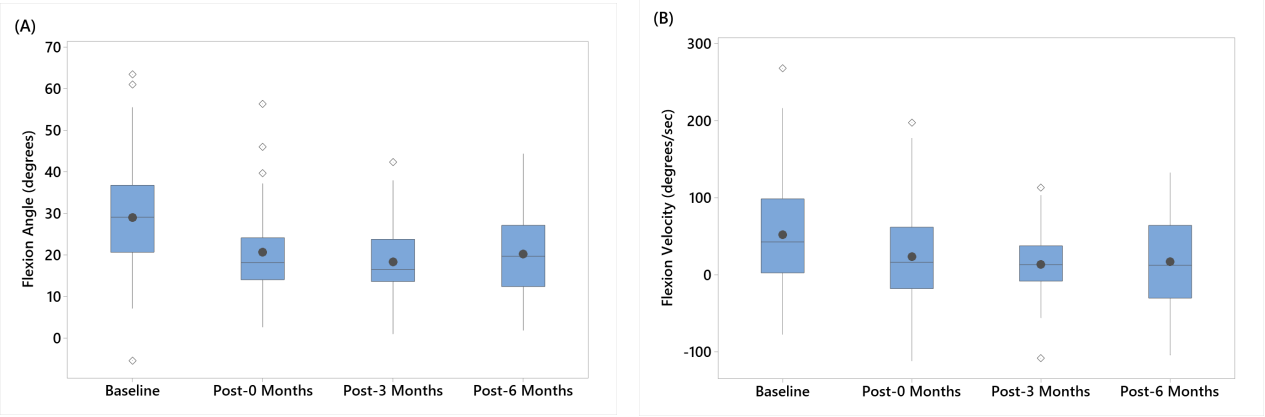

Figure 1. Peak (a) trunk flexion and (b) trunk flexion velocity at recovery foot contact following perturbation measured before, immediately after, and three and six months after training. The dot represents the mean value. The diamonds represent outliers. There was a significant post-training decrease in trunk flexion and velocity which indicated a significant improvement in trunk flexion control. This improvement did not change over time post-training.

- The training resulted in a reduction of falls in the free-living environment. Before training, participants reported a median (ICR) of 2 (0-4) falls/month. There was a tendency toward a

difference (p=0.14) in the pre-training fall rate depending on the level of injury. The LP group reported the highest rate of 3 (1.75-6.25) falls/month, followed by the TFA group at 1.5 (0-4.75) falls/month, then the BTTA group at 1.0 (0.5-8.5) falls/month, and finally the TTA group with 0 (0-3) falls/month. Immediately after training, the fall rate decreased to 1 (0-2) fall/month (p=0.29), decreased to 0 (0-2) falls/month at three months (p=0.04), and was 0 (0-1) at six months post training which indicates the fall reduction was maintained with less variability (p=0.005).

- Participant-reported outcomes indicated that 63% of participants had increased confidence in their ability to recover from postural perturbations in the community which was attributed to a change in the way they recovered from the trip. Importantly, 60% of all participants felt that the training program had a positive impact on their life and 97% felt that the training program was beneficial.

- **What opportunities for training and professional development has the project provided?**
  Nothing to report.

- **How were the results disseminated to communities of interest?**
  Collected data were disseminated to the scientific community through scientific conferences and peer-reviewed scientific journals. Study methodologies were also translated via in-services with local clinical teams and stakeholders.
  - 5 abstracts presented at the Military Health System Research Symposium
  - 4 abstracts presented at the American Society of Biomechanics Annual Meeting
  - 1 abstract presented at the International Society of Biomechanics World Congress
  - 1 abstract presented at the Society of Clinical Research Associates Annual Conference
  - 1 abstract presented at the 12th Annual Joint National Capital Region Research Competition
  - 3 manuscripts published in Gait & Posture
  - 1 manuscript published in Medical Engineering & Physics
  - 2 manuscripts under review
  - 4 manuscripts in preparation

- **What do you plan to do during the next reporting period to accomplish the goals?**
  Nothing to report

4. IMPACT

- **What was the impact of the development of the principal discipline(s) of the project?**

  This study has introduced a novel and effective rehabilitation method that uses an innovative training technique. The training is aimed at increasing the ability of patients with lower extremity trauma to respond to challenging postural perturbations and thus improve their functional capabilities. The results indicate that task-specific training can be an effective rehabilitation method to reduce falls in Service members with diverse types of amputations and limb preservation procedures following lower extremity trauma. Improving balance confidence and reducing falls can lead to increased participation in occupational, recreational, and social activities. In turn, the increased socialization will result in an improved quality of life.

- **What was the impact on other disciplines?**
  Nothing to report.

- **What was the impact on technology transfer?**
  Nothing to report.

- **What was the impact on society beyond science and technology?**
  Nothing to report.

5. CHANGES/PROBLEMS

- **Changes in approach and reasons for change**
  Nothing to report.

- **Actual or anticipated problems or delays and actions or plans to resolve them**
  There were significant delays in beginning the project due to issues receiving HRPO approval and getting the treadmills installed and functioning. Additionally, the project experience further delays because of technical issues with the treadmills and COVID-19 restricting the ability to recruit and collect data. Despite these delays, we were able to meet our recruitment and data collection goals

- **Changes that had a significant impact on expenditures**
  Nothing to report.

- **Significant changes in use or care of human subjects**
  None.

- **Significant changes in use or care of vertebrate animals**
  Not applicable.

- **Significant changes in use of biohazards and/or select agents**
  Not applicable.

6. PRODUCTS

- **Publications, conference papers, and presentations**
  Journal Publications:

Taylor L, Miller E, Kaufman KR. Static and dynamic validation of inertial measurement units. *Gait & Posture*, 57:80-84, 2017.

Miller EJ; Kaufman KR. Comparison of overhead harness configurations for measuring trunk kinematics during treadmill disturbances. *Gait & Posture*. 68:15-17, 2019 Feb.

Miller EJ, Kaufman KR. Cross-sectional validation of inertial measurement units for estimating trunk flexion kinematics during treadmill disturbances. *Medical Engineering & Physics,* 70:51-54, 2019 Aug.

Acasio, J.C., Guerrero, N.A., Sheehan, R.C., Butowicz, C.M., Tullos, M.L., Mahon, C.E., Stewart, J.M., Zai, C.Z., Kingsbury, T.D., Grabiner, M.D., Dearth, C.L., Kaufman, K.R., Hendershot, B.D. Assessments of Trunk Postural Control within a Fall-Prevention Training Program for Service Members with Lower Limb Trauma and Loss. *Gait & Posture,* In Press 2021.

Acasio, J.C., Tullos, M.L., Mahon, C.E., Khatri, B.R., Kaufman, K.R., Dearth, C.L., Hendershot, B.D. (2020) A Within-Subject Comparison of Functional Outcomes between

Limb Salvage versus Amputation *Disability and Rehabilitation,* Under Review (submitted October 18, 2020).

Kaufman, KR, Miller EJ, Huyber CM, Sheehan RC, Grabiner MD, Wyatt M, Zai CZ, Kingsbury T, Tullos ML, Acasio JC, Mahon CE, Hendershot BD, Dearth CL. Fall Prevention Training for Service members following Lower Extremity Trauma. *Clinical Orthopaedics and Related Research,* Under Review (submitted March 10, 2021).

Abstracts:

Taylor L, Miller E, Kaufman KR. Validation of inertial measurement units. 41st annual meeting of the American Society of Biomechanics, Boulder, Colorado, August 8-11, 2017.

Miller E, Kaufman KR. Validation of IMUs for Trunk Kinematics during Treadmill Disturbances. 42nd Annual Meeting of the American Society of Biomechanics, Rochester, MN, August 8-11, 2018.

Kenton R. Kaufman, Joseph J. Wick, Christine M. Huyber, Riley Sheehan, Mark D. Grabiner, Marilynn Wyatt, Claire Z. Zai, Meghan L. Tullos, Brad D. Hendershot, and Christopher L. Dearth. Development of an Integrated Platform for Performing Multi-Center Extremity Trauma and Rehabilitation Research. Military Health System Research Symposium, August 19-22, 2019, Kissimmee, FL.

Brad D. Hendershot, Julian C. Acasio, Courtney M. Butowicz, Caitlin E. Mahon, Meghan Tullos, Riley C. Sheehan, Emily Miller, Marilynn Wyatt, Clair Z. Zai, Jules Stewart, Christopher L. Dearth, Mark D. Grabiner, and Kenton R. Kaufman. Clinical Assessment of Trunk Postural Control within a Fall-Prevention Training Program for Service Members with Lower Extremity Trauma and Limb Loss. Military Health System Research Symposium, August 19-22, 2019, Kissimmee, FL.

Kenton R. Kaufman, Joseph J. Wick, Christine M. Huyber, Riley Sheehan, Mark D. Grabiner, Marilynn Wyatt, Claire Z. Zai, Meghan L. Tullos, Brad D. Hendershot, and Christopher L. Dearth. Development of an Integrated Platform for Performing Multi-Center Extremity Trauma and Rehabilitation Research. Society of Clinical Research Associates Annual Conference, September 27-29, 2019, San Antonio, TX.

Miller EJ, Kaufman KR. Cross-sectional validation of inertial measurement units for estimating trunk flexion kinematics during treadmill disturbances. Presented at XXVII Congress of the International Society of Biomechanics, July 31 – August 4, 2109, Calgary, Canada.

Riley Sheehan, Mark Grabiner, Trevor Kingsbury, Brad Hendershot, Kenton Kaufman. Step Width Variables are not Meaningfully Correlated with Stumble or Fall Incidence in a High Functioning Population with Lower Limb Trauma. American Society of Biomechanics Annual Meeting, August 2020, Atlanta, GA.

Claire Z. Zai, Trevor D. Kingsbury, John-David Collins, Julianne Stewart, Riley Sheehan, Brad D. Hendershot, Christopher L. Dearth, Kenton Kaufman. Evaluation of the Four Square Step Test as an Outcome Measure in a Fall Prevention Program. American Society of Biomechanics Annual Meeting, August 2020, Atlanta, GA.

Kenton R. Kaufman, Emily J. Miller, Christine M. Huyber, Riley Sheehan, Mark D. Grabiner, Marilynn Wyatt, Claire Z. Zai, Trevor Kingsbury, Meghan L. Tullos, Brad D. Hendershot, Christopher L. Dearth. Fall-Prevention Training Program for Service Members with Lower Limb Trauma and Loss. Military Health System Research Symposium, August 2020, Kissimmee, FL.

Noel Guerrero, Riley Sheehan, Brad D. Hendershot, Trevor Kingsbury, Kenton Kaufman. Trunk neuromuscular control assessed in the lab is not correlated with perturbation recovery improvement following a trip training intervention. Military Health System Research Symposium, August 2020, Kissimmee, FL.

Claire Z. Zai, Trevor D. Kingsbury, John-David Collins, Julianne Stewart, Riley Sheehan, Brad D. Hendershot, Christopher L. Dearth, Kenton Kaufman. Evaluation of the Four Square Step Test as an Outcome Measure in a Fall Prevention Program. Military Health System Research Symposium, August 2020, Kissimmee, FL.

Hendershot, B.D., Acasio, J.C., Butowicz, C.M., Mahon, C.E., Tullos, M., Sheehan, R.C., Miller, E., Wyatt, M., Zai, C.Z., Stewart, J., Dearth, C.L., Grabiner, M.D., Kaufman, K.R. (2020) Clinical Assessment of Trunk Postural Control within a Fall-Prevention Training Program for Persons with Lower Limb Trauma. *12th Annual Joint National Capital Region Research Competition*, Bethesda, MD, USA. [Finalist for Robert A. Phillips Award (top 4 of 209 submissions)] [PODIUM]

- **Website(s) or other Internet site(s)**
  Nothing to report.

- **Technologies or techniques**
  Nothing to report.

- **Inventions, patent applications, and /or licenses**
  Nothing to report.

- **Other products**
  Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

- **What individuals have worked on the project?**

Name:	Kenton Kaufman, PhD, PE
Project Role:	Principal Investigator, Mayo Clinic
Nearest person month worked:	11

Contribution to Project:	Dr. Kaufman provided overall project leadership for this research effort. He held regular meetings with the Co-Investigators. He prepared materials for the regulatory reviews. He developed the standard operating procedures for the research protocols. He has served as the liaison with the Grants Officer's Representative and provided the required quarterly and annual reports. He was responsible for all work products. He is the first author on one manuscript summarizing the entire project.
Funding Support:	

Name:	Leah Taylor, MS
Project Role:	Research Engineer, Mayo Clinic
Nearest person month worked:	8
Contribution to Project:	Ms. Taylor worked on the static and dynamic validation of the Inertial Measurement Units (IMU). She authored a manuscript on the validation.
Funding Support:	

Name:	Emily Miller, MS
Project Role:	Research Engineer, Mayo Clinic
Nearest person month worked:	16
Contribution to Project:	Ms. Miller developed the custom software for creating the postural perturbations on the microprocess-controlled treadmills. She also provided custom processing scripts for data analysis and assured quality data throughout the research project.
Funding Support:	

Name:	Christine Huyber, CCRP
Project Role:	Kinesiologist, Mayo Clinic
Nearest person month worked:	6
Contribution to Project:	Ms. Huyber developed the integrated platform for data collection and analysis using REDCap. She maintained the system and provided training from all study staff.
Funding Support:	

Name:	Marilynn Wyatt, MA, PT
Project Role:	Site Principal Investigator, NMCSD
Nearest person month worked:	12
Contribution to Project:	Ms. Wyatt was the Naval Medical Center (NMCSD) site principal investigator for the project. She coordinated the work accomplished at NMCSD. She attended study meetings with the other Co-Investigators and contributed to quarterly and yearly reports, abstracts, and publications. Coordinated sub-award with Geneva foundation.
Funding Support:	From 2015-2018 Ms. Wyatt was a federal employee and received no compensation from this award.

Name:	Taylor Henderson, BS
Project Role:	Engineer, NMCSD
Nearest person month worked:	3
Contribution to Project:	Ms. Henderson served as an engineer for the project. She served as needed to keep the hardware and software for data collection.
Funding Support:	Geneva Foundation Sub-award

Name:	John-David Collins, MA, ATC
Project Role:	Biomechanist/AI, NMCSD
Nearest person month worked:	10
Contribution to Project:	Mr. Collins served as an Associate Investigator for the project working as the research Biomechanist. He helped with recruitment, data collection, training and long-term follow-up for the project 2017-2018.
Funding Support:	Geneva Foundation Sub-award

Name:	Claire Zai, MS
Project Role:	Clinical Research Coordinator, NMCSD
Nearest person month worked:	20
Contribution to Project:	Ms. Zai served as the protocol coordinator for the team as well as researcher. She coordinated HRPO and IRB reviews. She conducted testing and training sessions at NMCSD. She assisted with data processing, documentation, and data base entry for the site from 2018-2020.
Funding Support:	Geneva Foundation Sub-award

Name:	Julianne Stewart, PT, DPT
Project Role:	Research Physical Therapist, NMCSD
Nearest person month worked:	22
Contribution to Project:	Dr. Stewart served as the research physical therapist for NMCSD. She screened and scheduled subjects. She maintained the sites REDCap data. She also was responsible for the subject consent process, questionnaire administration, PT Evaluations, and clinical supervision of the subject during treadmill assessments.
Funding Support:	Geneva Foundation Sub-award

Name:	Tatiana Djafar, MA
Project Role:	Engineer, NMCSD
Nearest person month worked:	28
Contribution to Project:	Ms. Djafar was the NMCSD site engineer for the project from 2016-2018. Her role was to oversee the technical aspects of the project. She worked closely with the Mayo engineer (Miller) to troubleshoot, fine-tune, and finalize the custom software for the AMTI treadmill. She helped write and finalize the general SOP and helped develop a training plan for the other sites. She was involved in enrollment, data collection, and subject training.
Funding Support:	Geneva Foundation Sub-award

Name:	Amanda Wingate
Project Role:	Clinical Research Coordinator, NMCSD
Nearest person month worked:	2
Contribution to Project:	Ms. Wingate served as the protocol coordinator for the team as well as researcher. She coordinated HRPO and IRB reviews. She conducted testing and training sessions at NMCSD. She assisted with data processing, documentation and data base entry for the site in 2018.
Funding Support:	Geneva Foundation Sub-award

Name:	Pinata Sessoms, PhD
Project Role:	AI, NHRC
Nearest person month worked:	4
Contribution to Project:	Dr. Sessoms was the NHRC site lead for the project. She lent her expertise in all aspects of the project and especially in the utilization of the IMUs and treadmill integration. She actively participated in project teleconferences and helped with troubleshooting software and hardware at NMCSD.
Funding Support:	Dr. Sessoms is a federal employee and received no compensation from this award.

Name:	Trevor Kingsbury, MS
Project Role:	Biomechanist/AI, NMCSD
Nearest person month worked:	6
Contribution to Project:	Mr. Kingsbury was an associate investigator for the project. He served as onsite supervisor and PI for all IRB matters from 2018-2020. He supervised data collection, data verification and he maintained the regulatory records. He contributed to abstract and paper publications.
Funding Support:	Mr. Kingsbury is a federal employee and received no compensation from this award.

Name:	Jason Wilken, PT, PhD
Project Role:	Site PI/Collaborator
Nearest person month worked:	4
Contribution to Project:	Dr. Wilken served as the site PI from 2015-2017 during which he helped coordinate the regulatory approval and purchase and installation of the treadmill. In 2017, he left the CFI, but remained on the project as a collaborator working at the University of Iowa through 2019. During that time, he participated in regular project teleconference meetings.
Funding Support:	Federal Employee/Subaward to the University of Iowa

Name:	John Fergason, CP
Project Role:	Site PI/AI
Nearest person month worked:	5
Contribution to Project:	John Fergason served as the site PI from 2017-2018, then as an AI into 2019. During that time, he helped coordinate study activities, assisted with participant recruitment, and

	participated in regular project teleconference meetings.
Funding Support:	Federal Employee

Name:	Riley C. Sheehan, PhD
Project Role:	Site Principal Investigator, Center for the Intrepid, Brooke Army Medical Center
Nearest person month worked:	20
Contribution to Project:	Dr. Sheehan served as an AI until taking over as PI in 2018. He coordinated study execution and the administration of the Henry Jackson Foundation sub-award for the effort at the CFI. This included assisting with preparing study equipment and SOPs, collecting data, writing scripts for and coordinating data processing efforts, and preparing conference abstracts and manuscripts based on the study finding. He also participated in regular project teleconference meetings.
Funding Support:	Henry M. Jackson Foundation Sub-award

Name:	Andrea Ikeda
Project Role:	AI
Nearest person month worked:	2
Contribution to Project:	Ms. Ikeda participated in regular teleconferences with Co-Investigators as well as assisting with participant recruitment and data collection.
Funding Support:	Federal Employee

Name:	Noel Guerrero, BS
Project Role:	Research Assistant, Center for the Intrepid, Brooke Army Medical Center
Nearest person month worked:	17
Contribution to Project:	Mr. Guerrero participated in regular teleconferences with Co-Investigators. He has also assisted in recruitment and scheduling of participants, and data collection and processing. Additionally, he contributed to the preparation of abstracts and manuscripts.
Funding Support:	Henry M. Jackson Foundation Sub-award

Name:	Jonathan Wilson, PT, DPT
Project Role:	Research Physical Therapist, Center for the Intrepid, Brooke Army Medical Center
Nearest person month worked:	10
Contribution to Project:	Mr. Wilson assisted with data collection and training sessions. Additionally, he contributed to the preparation of abstracts and manuscripts.
Funding Support:	Henry M. Jackson Foundation Sub-award

Name:	Christopher L. Dearth, PhD
Project Role:	Site Principal Investigator, Walter Reed National Military Medical Center
Nearest person month worked:	10
Contribution to Project:	Dr. Dearth served as the WRNMMC site lead for the project.

	Dr. Dearth participated in all study meetings, coordinated equipment orders/deliveries/install, and engaged in discussions with WRNMMC clinical and research staff to ensure continued subject enrollment and data collection in the upcoming year. Dr. Dearth was a co-author on study dissemination products.
Funding Support:	Federal Employee

Name:	Bradford D. Hendershot, PhD
Project Role:	Associate Investigator, Walter Reed National Military Medical Center
Nearest person month worked:	10
Contribution to Project:	Dr. Hendershot served as an Associate Investigator for the project. Dr. Hendershot participated in all study meetings, assisted with the coordination of equipment orders/deliveries/install, and engaged in discussions with WRNMMC clinical and research staff to ensure continuation of subject enrollment and data collection. Dr. Hendershot was a co-author on study dissemination products.
Funding Support:	Federal Employee

Name:	Meghan Tullos, PTA, CBDT
Project Role:	Associate Investigator, Walter Reed National Military Medical Center
Nearest person month worked:	30
Contribution to Project:	Ms. Tullos served as an Associate Investigator for the project. Ms. Tullos has been the primary clinician for the WRNMMC study site. Ms. Tullos led patient coordination and scheduling efforts. Ms. Tullos was a co-author on study dissemination products.
Funding Support:	Henry M. Jackson Foundation Sub-award

Name:	Julian Acasio, MS
Project Role:	Associate Investigator, Walter Reed National Military Medical Center
Nearest person month worked:	15
Contribution to Project:	Mr. Acasio served as an Associate Investigator for the project. Mr. Acasio was crucial in the data processing and re-processing efforts. Mr. Acasio was a co-author on study dissemination products.
Funding Support:	Henry M. Jackson Foundation Sub-Award

Name:	Caitlin Mahon, MS
Project Role:	Associate Investigator, Walter Reed National Military Medical Center
Nearest person month worked:	8
Contribution to Project:	Ms. Mahon served as an Associate Investigator for the project. Ms. Mahon assisted clinical staff with data collection and patient coordination. Ms. Mahon was a co-author on

	study dissemination products.
Funding Support:	Henry M. Jackson Foundation Sub-award

Name:	Mark D. Grabiner, PhD
Project Role:	Site Principal Investigator, University of Illinois-Chicago
Nearest person month worked:	5
Contribution to Project:	Dr. Grabiner attended the regularly scheduled meetings with the research team. The project-based work at UIC is focused on post-collection analysis of biomechanical data collected at and transferred from Mayo, NMCSD, CFI, and WRNMMC.
Funding Support:	

- **Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**
  No.

- **What other organizations were involved as partners?**
  Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

- **Collaborative Awards**

- **Quad Chart**

9. APPENDICES