

**AWARD NUMBER:** W81XWH-22-1-0216

**TITLE:** Enhancing Motor Function in Individuals with Lower Limb Amputation Through Peer-Based Balance and Fall Recovery Skill Training

**PRINCIPAL INVESTIGATOR:** Szu-Ping Lee

**CONTRACTING ORGANIZATION:** University of Nevada, Las Vegas, NE

**REPORT DATE:** October 2023

**TYPE OF REPORT:** Annual

**PREPARED FOR:** U.S. Army Medical Research and Development Command  
Fort Detrick, Maryland 21702-5012

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# REPORT DOCUMENTATION PAGE

*Form Approved*  
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<b>1. REPORT DATE</b> October 2023		<b>2. REPORT TYPE</b> Annual		<b>3. DATES COVERED</b> 01Sep2022-31Aug2023	
<b>4. TITLE AND SUBTITLE</b> Enhancing Motor Function in Individuals with Lower Limb Amputation Through Peer-Based Balance and Fall Recovery Skill Training				<b>5a. CONTRACT NUMBER</b> W81XWH-22-1-0216	
				<b>5b. GRANT NUMBER</b> OP210027	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b>  Szu-Ping Lee  E-Mail: <a href="mailto:szu-ping.lee@unlv.edu">szu-ping.lee@unlv.edu</a>				<b>5d. PROJECT NUMBER</b> 0011734925	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  University of Nevada, Las Vegas 4505 S. Maryland Parkway, Las Vegas, Nevada, 89154				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>  U.S. Army Medical Research and Development Command Fort Detrick, Maryland 21702-5012				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b>  Approved for Public Release; Distribution Unlimited					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b>  We have completed the first year of the proposed 2-year project. The overall goal of this research project is to investigate the effectiveness (Aim 1) and the scientific foundation (Aim 2) of peer-based prosthetic skill training in individuals with leg amputation. <b>Our belief is that amputee learners will show improved skill learning when observing demonstrations from other amputees, as opposed to observing nonamputee models.</b> We will accomplish our objective by executing the following two aims: <i>Aim 1: Determine the effects of peer-based observation training on sensori-motor performance and learning in individuals with LLA.</i> <i>Aim 2: Examine the differences in visual focus, behavioral psychometrics, and brain activation patterns during and after observing motor task demonstrations from amputee peers vs. non-amputees.</i>					
<b>15. SUBJECT TERMS</b> None listed.					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>  Unclassified	<b>18. NUMBER OF PAGES</b>  15	<b>19a. NAME OF RESPONSIBLE PERSON</b> USAMRDC
<b>a. REPORT</b>  Unclassified	<b>b. ABSTRACT</b>  Unclassified	<b>c. THIS PAGE</b>  Unclassified			<b>19b. TELEPHONE NUMBER</b> (include area code)

## TABLE OF CONTENTS

	<u>Page</u>
1. Introduction	4
2. Keywords	4
3. Accomplishments	4
4. Impact	7
5. Changes/Problems	8
6. Products	10
7. Participants & Other Collaborating Organizations	13
8. Special Reporting Requirements	15
9. Appendices	15

## 1. INTRODUCTION:

The overall objective of this project is to investigate the clinical scientific bases of peer-based sensori-motor skill training in individuals with LLA. Our general hypothesis is that participants observing and learning from models who share a similar lower limb amputation with them will exhibit enhanced motor learning when compared to observing non-amputee models.

## 2. KEYWORDS:

amputation, lower limb loss, mobility, peer-support; EEG; eye tracking; motor learning; balance; fall recovery; fall risk

## 3. ACCOMPLISHMENTS:

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

<b>Specific Aim 1 - Determine the effects of peer-based observation training on sensori-motor performance and learning in individuals with LLA.</b>	<b>Proposed Timeline</b>	<b>%Progress</b>
<b>Major Task 1: Obtain IRB and HRPO study approvals</b>	Months	100%
Subtask 1.1: Refine recruitment and screening criteria.	0-1	100%
Subtask 1.2: Finalize consent form, training and testing protocols.	0-1	100%
Subtask 1.3: IRB protocol submission and amendments (UNLV and VA)	1-2	100%
<b>Major Task 2: Initiate and complete Aim 1 study</b>		
Subtask 2.1: Establishing and practicing the balance and fall recovery study protocols, including the recording of the videos that will be used in the training.	2-6	100%
Subtask 2.2: Recruit, screen, and consent participants. Randomly assign the order of conditions (amputee peers vs. non-amputee).	4-14	40%
Subtask 2.3: Participant training and data collection.	5-20	20%
Subtask 2.4: Motor learning outcome evaluation (before, during, and after training).	5-20	20%
Subtask 2.5: Data analysis.	16-22	10%

<b>Specific Aim 2 - Examine the differences in visual focus, behavioral psychometrics, and brain activation patterns during and after video observation and training of motor tasks performed by amputee peers vs. non-amputees.</b>		
<b>Major Task 3: Initiate and complete Aim 2 study</b>		
Subtask 3.1: Testing environment setup, SOP, investigator training.	2-6	95%
Subtask 3.2: Prepare and validate demonstration videos.	2-6	100%
Subtask 3.3: Recruit, screen, and consent participants.	4-14	40%
Subtask 3.4: Perform EEG, eye tracking, and behavioral assessments during observation of motor task demonstration videos.	5-20	20%
Subtask 3.5: Data analysis.	16-22	
<b>Major Task 4: Results Dissemination</b>		
Subtask 1: Prepare data presentations for scientific conferences	20-	
Subtask 2: Manuscript preparation	20-	
Subtask 3: Dissemination of results to relevant amputee peer-support organizations (e.g. military and VA amputee care clinics, Amputee Coalition of America, and local support groups)	20-	

### What was accomplished under these goals?

During this reporting period, the following was accomplished:

- Major Task 1 and all the sub-aims were completed in September 2022 (UNLV IRB approval 9/12/2022; OHRO approval 9/13/2022).
- Major Task 2, Subtask 2.1: In this reporting period, all study protocols (balance/fall recovery training, eye tracking, and EEG) have been finalized. We started data collection in August 2023.
- Major Task 2, Subtask 2.2 and Major Task 3, Subtask 3.3: To test our study protocol and to have reference data from a control group, we have finished collecting data from 10 non-amputees and 2 pilot participants (non-ambulatory amputees to test our EEG and eye-tracking protocols). We have started recruiting participants with lower limb loss for the study. So far, 11 potential participants have committed to join the study (out of the target n=20). We will continue to recruit and enroll participants in the next period.
- Major Task 3, Subtask 3.1: We have finalized the research team that consists of the 2 CO-Is, 4 UNLV Doctor of Physical Therapy students, a PhD student, and a postdoc who will serve as the study coordinator. The training of the study coordinator and the physical therapy student researchers has been completed. The PhD student joined in August 2023, and her training is ongoing.
- Major Task 3, Subtask 3.2: The demonstration video recording has been completed.

## What opportunities for training and professional development has the project provided?

While this project was not specifically targeting training and professional development, it provides research training opportunities for the following research trainees and students:

- Fu-Lien (Frank) Wu, PT, PhD: post-doctoral researcher and coordinator for the project.
- Danna Shaw: Doctor of Physical Therapy student at UNLV
- JJ Chuang: Doctor of Physical Therapy student at UNLV
- Jewel Granados: Doctor of Physical Therapy student at UNLV
- Zoe Castle: Doctor of Physical Therapy student at UNLV
- Fateme Eskandari: PhD student in Interdisciplinary Health Science at UNLV

## How were the results disseminated to communities of interest?

The following manuscript has been submitted for publication in a top rehabilitation journal:

**Lee SP, Maluotoga M, Thind R, Lindsay L, Bhatta T, Miller CA. Utilization and Perception of Peer-Support After Lower Limb Loss in the United States: Potential Benefits on Mobility Outcomes. *Archives of Physical Medicine and Rehabilitation*. (1<sup>st</sup> revision, September 2023).**

Findings related to the current project has been presented in the following national physical therapy conference:

**Maluotoga M, Thind R, Lindsay L, Bhatta T, Miller C, Lee SP. Utilization and Perception of Peer-Support after Lower Limb Loss: Potential Benefits on Mobility Outcomes. *Proceedings of the American Physical Therapy Association Combined Sections Meeting, San Diego, California, USA, 2023*.**

#### **4. IMPACT:**

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

In addition to the knowledge dissemination described above, the research protocol developed for this project is useful for future investigations. We are preparing a technical report describing a protocol that allows participant-specific variable support during the stabilometer task. The instrument and the task are commonly used in motor learning research, and this protocol will be useful for other researchers.

**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?**

Because the goal of this project was to investigate the potential benefits of incorporating peer-support in rehabilitation after amputation, the current work indirectly raises awareness about amputee peer-support and amputation in general. The PI is currently a volunteer organizer for the Las Vegas Amputee Peer-Support Group that has about 500 members of patients, clinicians, and family. This study provides an opportunity for these community members to be engaged in research related to rehabilitation after amputation.

**5. CHANGES/PROBLEMS:**

Nothing to report

**Actual or anticipated problems or delays and actions or plans to resolve them**

There was some initial confusion regarding setting up the research expenditure account at UNLV, which impacted the recruiting and hiring of the postdoc researcher and our overall progress (October-December 2022). The issue has been resolved since (the postdoc was hired, and started in April 2023).

**Changes that had a significant impact on expenditures**

Hiring of the postdoc was delayed by 3 months, but it should not significantly impact on our expenditures.

**Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**

**Significant changes in use or care of human subjects**

Nothing to report. We have adhered to the approved human subject research protocol.

**Significant changes in use of biohazards and/or select agents**

Not applicable.

## 6. PRODUCTS:

- **Publications, conference papers, and presentations**  
**Journal publications.**

The PI is in the process of publishing the following study based on the preliminary data obtained for the project. The revised manuscript has been completed during this reporting period and submitted to the *Archives of Physical Medicine and Rehabilitation* on September 19<sup>th</sup>, 2023. The revised manuscript is currently under peer-review.

Lee SP, Maluotoga M, Thind R, Lindsay L, Bhatta T, Miller CA. **Utilization and Perception of Peer-Support After Lower Limb Loss in the United States: Potential Benefits on Mobility Outcomes (1<sup>st</sup> revision, under review)**

### **Books or other non-periodical, one-time publications.**

Nothing to report.

### **Other publications, conference papers and presentations.**

During the reporting period, the PI has given the following presentations regarding the psychosocial considerations of outcomes after amputation:

Invited presentations:

- Aesthetics and Function in O&P Design – Patient Engagement in Cosmetic Designing of Prosthesis: Current Practice and Potential Outcome Benefits. Organized Session, Annual Meeting & Scientific Symposium of the American Academy for Orthotists and Prosthetists. Nashville, TN, USA, March 4<sup>th</sup>, 2023.
- Beyond Physical: Benefits of Psychosocial Considerations in Treating Patients with Amputation. Department of Physical Therapy, Asia University, Taichung, Taiwan (January 4<sup>th</sup>, 2023)
- Beyond Physical: Benefits of Psychosocial Considerations in Treating Patients with Amputation. School and Graduate Institute of Physical Therapy, National Taiwan University, Taipei, Taiwan (December 27<sup>th</sup>, 2022)
- UNLV Tenure-Track Faculty Mentoring Group: Research Panel Discussion. September 16<sup>th</sup>, 2022.
- Rehabilitation after Limb Amputation: Current Evidence and Clinical Applications (with Scott Love). American Physical Therapy Association West Virginia Annual Conference. Wheeling, WV, USA, September 24-25, 2022.
- Rehabilitation after Lower limb Amputation - Impact of Psychosocial Factors on Patient Outcome (with Toran Macleod, Sheila Clemens, Chris Doerger, and Andrew Sawers). Educational session. American Physical Therapy Association Combined Sections Meeting, San Diego, USA, February 23<sup>rd</sup> 2023.

Peer-reviewed presentations:

- Clemens S, Kershaw K, **Lee SP**. Known racial-ethnic disparities in lower limb amputation rates in the U.S. persist into functional recovery after amputation. Proceedings of the World Congress of International Society of Prosthetics and Orthotics, Guadalajara, Mexico, 2023.
- Habashi K, Iida T, Yee B, **Lee SP**. Fear of Falling and Its Relation to Balance Task Performance in Individuals with Chronic Diabetes. Proceedings of the American Diabetes Association's 83<sup>rd</sup> Scientific Sessions, San Diego, California, USA, 2023
- Clemens S, **Lee SP**, MacLeod T, Verbsky M, Gailey R, Stark RK, Carnahan K, Crunkhorn A, Love S. Developing of Clinical Practice Guidelines (CPG) for Outcome Measures for Amputation Rehabilitation. Proceedings of the American Physical Therapy Association Combined Sections Meeting, San Diego, California, USA, 2023.

*List the URL for any Internet site(s) that disseminates the results of the research activities.*

Nothing to report.

- **Technologies or techniques**

The following protocol for inducing simulated tripping falls was published during this reporting period. This protocol was developed by us previously and is being used for the current study

Shih HT, Gregor RJ, and **Lee SP**. Description, Reliability, and Utility of a Novel Ground Reaction Force-Triggered Treadmill Protocol for Simulation of Tripping Falls. *PLOS ONE*, 18(4): e0284384

- **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?**

<b>Name</b>	<b>Project role</b>	<b>Researcher identifier</b>	<b>Nearest person month worked</b>	<b>Contribution to project</b>
Szu-Ping Lee	PI	0000-0003-0398-8256	4	Developed and obtained study approval, coordinated investigator recruitment and training
Hyunhwa Lee	Co-I	0000-0002-5625-3141	1	Assisted PI in study protocol development and investigator training
Joel Snyder	Co-I	0000-0002-5565-3063	1	Assisted PI in study protocol development and investigator recruitment and training
Fu-Lien Wu	Postdoc		6	Project coordinator
Carolee Winstein	Consultant		1	Assisted PI in study protocol development and investigator recruitment

Danna Shaw	Graduate student		1	UNLV Doctor of Physical Therapy student. Completed study orientation
Jer Ja Chuang	Graduate student		1	UNLV Doctor of Physical Therapy student. Completed study orientation
Jewel Granados	Graduate student		1	UNLV Doctor of Physical Therapy student. Completed study orientation
Zoe Castle	Graduate student		1	UNLV Doctor of Physical Therapy student. Completed study orientation

**Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**

Nothing to report.

**What other organizations were involved as partners?**

Nothing to report.

**8. SPECIAL REPORTING REQUIREMENTS**

**COLLABORATIVE AWARDS:**

**QUAD CHARTS:**

**9. APPENDICES:**