AWARD NUMBER: W81XWH-18-1-0806

TITLE: **Assistive Technology and Functional Outcomes Following Spinal Cord Injury**

PRINCIPAL INVESTIGATOR: Kimberley Monden, PhD

CONTRACTING ORGANIZATION: University of Minnesota (UMN)

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TYPE OF REPORT: Annual Progress Report

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

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5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

AND ADDRESS(ES)

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420 Delaware St. SE, MMC 297
Minneapolis, MN 55455

Louis Stokes Cleveland VAMC
10701 East Boulevard
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Development Command

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12. DISTRIBUTION / AVAILABILITY STATEMENT

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13. SUPPLEMENTARY NOTES

14. ABSTRACT

The activities accomplished in Year 4 include presentation of Aim 1 qualitative data by Dr. Monden at the February 2022 Rehabilitation Psychology conference and by Ms. Philippus at the International Spinal Cord Society (ISCoS) Annual Scientific Meeting in September 2022. An Aim 1 manuscript is in preparation for submission to the journal, *Disability and Rehabilitation: Assistive Technology.* We anticipate submitting the manuscript in November 2022.

Aim 2 accomplishments in this reporting period include enrolling our first LSCVAMC participant on 12/15/2021 and reaching a total 266 individuals with complete survey data. We anticipate reaching our target enrollment and completion goal of n=300 in the upcoming quarter.

15. SUBJECT TERMS

Spinal cord injury, assistive technology, qualitative, barriers, facilitators

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON USAMRDC
a. REPORT	b. ABSTRACT	c. THIS PAGE			19bTELEPHONE NUMBER *(include area code)*
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Standard Form 298 (Rev. 8-98)

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1. **INTRODUCTION:** *Narrative that briefly (one paragraph) describes the subject, purpose and scope of the research.*

Assistive technology (AT) for individuals with SCI, specifically computer and smartphone equipment and the hardware and software devices that make these more usable, is routinely prescribed in multidisciplinary rehabilitation programs and its use has been well documented in the literature. However, evidence regarding the impact of AT on functional (e.g., employment, social participation) and/or psychosocial (e.g., self-efficacy, quality of life) outcomes after tetraplegia is limited. The primary goals of this study are to (1) qualitatively examine barriers and facilitators to AT access and utilization after tetraplegia, (2) assess for variation of AT use across insurance providers, (2) assess the relationship between AT use and productivity, and (3) assess the relationship between AT use and psychosocial outcomes to inform clinical practice, inform future policy, and influence reimbursement standards for AT.

2. **KEYWORDS:** *Provide a brief list of keywords (limit to 20 words).*

spinal cord injury, assistive technology, qualitative, barriers, facilitators

3. **ACCOMPLISHMENTS:** *The PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction.*

What were the major goals of the project?
List the major goals of the project as stated in the approved SOW. If the application listed milestones/target dates for important activities or phases of the project, identify these dates and show actual completion dates or the percentage of completion.

Major Task 1a: Obtain IRB and HRPO approval, establish team meeting teleconferences.
- Craig Hospital received IRB approval on 9/14/2018, which was before the target date of 10/31/18.
- LSCVAMC received IRB approval on 2/14/2019, which was two months behind the target date of 12/30/18.
- HRPO approval was anticipated by the end of March 2019, but was not received until 8/14/19.
- All research staff were hired by the target date of December 2018.

Major Task 1b: **Conduct focus groups/interviews.**
- Three focus groups were completed at each site. Focus groups were conducted from November 2019 to January 2020.

Major Task 2: Analyze qualitative data.
- Data analysis complete in October 2022.

Major Task 3: Conduct quantitative data collection
- IRB approval of quantitative data collection forms (UMN - 8/20/2021; LSCVAMC 10/8/2021)
- Web-based database created and tested
- UMN recruitment materials distributed on 9/9/2021
- First UMN participant enrolled on 9/9/2021
- First LSCVAMC participant enrolled on 12/15/2021
- To date, we have complete data on 260 participants (87% of our target goal)

Major Task 4: Analyze quantitative data
- Logistic and general linear regressions will be used to analyze the data once data collection is complete.

Major Task 5: Dissemination
- Aim 1 manuscript preparation in progress
- Aim 2 manuscript pending completion of data collection and analysis
- Aim 1 results were presented at a national conference and one at an international conference

What was accomplished under these goals?
For this reporting period describe: 1) major activities; 2) specific objectives; 3) significant results or key outcomes, including major findings, developments, or conclusions (both positive and negative); and/or 4) other achievements. Include a discussion of stated goals not met. Description shall include pertinent data and graphs in sufficient detail to explain any significant results achieved. A succinct description of the methodology used shall be provided. As the project progresses to completion, the emphasis in reporting in this section should shift from reporting activities to reporting accomplishments.

Major activities for this reporting period include:

- Aim 1 results presented at a national and an international conference
- First LSCVAMC individual enrolled
- 87% of Aim 2 data have been collected

What opportunities for training and professional development has the project provided?
If the project was not intended to provide training and professional development opportunities or there is nothing significant to report during this reporting period, state "Nothing to Report."

Nothing to report.

How were the results disseminated to communities of interest?
If there is nothing significant to report during this reporting period, state "Nothing to Report.

"Barriers and Facilitators to Assistive Technology Use among Civilians and Veterans with Tetraplegia" was presented at the 2022 Rehabilitation Psychology Conference in Louisville, KY.

Philippus, A., Coker, J., Charlifue, S., Monden, K. "Assistive technology allows me to see all the possibilities versus everything that you can't do." Barriers and Facilitators to Assistive Technology Use among Veterans and Civilians with Tetraplegia. [Conference session]. International Spinal Cord Society (ISCoS) Annual Scientific Meeting, 2022 Sept, Toronto, Canada.

What do you plan to do during the next reporting period to accomplish the goals?
If this is the final report, state "Nothing to Report."

Major task 4: Quantitative data collection

- Collect data
- Complete data entry

Major task 5: Analyze quantitative data

- Complete statistical analysis

Additionally, we will submit manuscripts of our qualitative and quantitative findings.

4. IMPACT: D*escribe distinctive contributions, major accomplishments, innovations, successes, or any change in practice or behavior that has come about as a result of the project relative to:*

What was the impact on the development of the principal discipline(s) of the project?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Nothing to report.

What was the impact on other disciplines?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Nothing to report.

What was the impact on technology transfer?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Nothing to report.

What was the impact on society beyond science and technology?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Nothing to report.

5. **CHANGES/PROBLEMS:** *The PD/PI is reminded that the recipient organization is required to obtain prior written approval from the awarding agency grants official whenever there are significant changes in the project or its direction. If not previously reported in writing, provide the following additional information or state, "Nothing to Report," if applicable.*

Changes in approach and reasons for change
Describe any changes in approach during the reporting period and reasons for these changes. Remember that significant changes in objectives and scope require prior approval of the agency.

Nothing to report.

Actual or anticipated problems or delays and actions or plans to resolve them
Describe problems or delays encountered during the reporting period and actions or plans to resolve them.

Nothing to report.

Changes that had a significant impact on expenditures
Describe changes during the reporting period that may have had a significant impact on expenditures, for example, delays in hiring staff or favorable developments that enable meeting objectives at less cost than anticipated.

Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents
Describe significant deviations, unexpected outcomes, or changes in approved protocols for the use or care of human subjects, vertebrate animals, biohazards, and/or select agents during the reporting period. If required, were these changes approved by the applicable institution committee (or equivalent) and reported to the agency? Also specify the applicable Institutional Review Board/Institutional Animal Care and Use Committee approval dates.

Significant changes in use or care of human subjects

Nothing to report.

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: *List any products resulting from the project during the reporting period. If there is nothing to report under a particular item, state "Nothing to Report."*

- **Publications, conference papers, and presentations**
  Report only the major publication(s) resulting from the work under this award.

  Journal publications. *List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

Nothing to report.

  Books or other non-periodical, one-time publications. *Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like. Identify for each one-time publication: author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (e.g., book, thesis or dissertation); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).*

Nothing to report.

  Other publications, conference papers and presentations. *Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication as noted above. List presentations made during the last year (international, national, local societies, military meetings, etc.). Use an asterisk (*) if presentation produced a manuscript.*

Nothing to report.

- **Website(s) or other Internet site(s)**
  List the URL for any Internet site(s) that disseminates the results of the research activities. A short description of each site should be provided. It is not necessary to include the publications already specified above in this section.

Nothing to report.

- **Technologies or techniques**
  Identify technologies or techniques that resulted from the research activities. Describe the technologies or techniques were shared.

Nothing to report.

- **Inventions, patent applications, and/or licenses**
  Identify inventions, patent applications with date, and/or licenses that have resulted from the research. Submission of this information as part of an interim research performance progress report is not a substitute for any other invention reporting required under the terms and conditions of an award.

Nothing to report.

- **Other Products**
  Identify any other reportable outcomes that were developed under this project. Reportable outcomes are defined as a research result that is or relates to a product, scientific advance, or research tool that makes a meaningful contribution toward the understanding, prevention, diagnosis, prognosis, treatment and /or rehabilitation of a disease, injury or condition, or to improve the quality of life. Examples include:

Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Provide the following information for: (1) PDs/PIs; and (2) each person who has worked at least one person month per year on the project during the reporting period, regardless of the source of compensation (a person month equals approximately 160 hours of effort). If information is unchanged from a previous submission, provide the name only and indicate "no change".

Name:	Kimberley Monden, PhD
Project Role:	Co-PI
Researcher Identifier:	https://orcid.org/0000-0002-5207-0452
Nearest person-month worked:	2.52
Contribution to Project:	

Name:	Angela Philippus, MS
Project Role:	Study Coordinator
Research Identifier:	
Nearest person-month worked:	6.0
Contribution to Project:	New Personnel

Name:	Martin Kilbane, PT, DPT, OCS
Project Role:	Site PI
Researcher Identifier:	
Nearest person-month worked:	1.25
Contribution to Project:	No change

Name:	Emily Johnson
Project Role:	Research Assistant
Researcher Identifier:	
Nearest person-month worked:	1.25
Contribution to Project:	No change

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

If the active support has changed for the PD/PI(s) or senior/key personnel, then describe what the change has been. Changes may occur, for example, if a previously active grant has closed and/or if a previously pending grant is now active. Annotate this information so it is clear what has changed from the previous submission. Submission of other support information is not necessary for pending changes or for changes in the level of effort for active support reported previously. The awarding agency may require prior written approval if a change in active other support significantly impacts the effort on the project that is the subject of the project report.

Kimberley Monden, PhD

- Title: Minnesota Regional Spinal Cord Injury Model System
  Agency: National Institute on Disability, Independent Living, and Rehabilitation Research
  Effort: 0.48 CM paid, 0.72 CM cost-shared
  Dates: 9/1/2021 – 8/31/2026
  Funding: total

- Title: Adaptation and Dissemination of the Spinal Cord Injury Physical Activity Guidelines
  Agency: Paralyzed Veterans of America Education Foundation
  Effort: 1.2 CM
  Dates: 6/1/2021 – 5/31/2022
  Funding: total

- Title: The Impact of Injustice Appraisals on Psychosocial Outcomes Following Spinal Cord Injury: A Longitudinal Study
  Agency: Department of Defense, CDMRP, SCIRP (SCP200102)
  Effort: 2.4 CM
  Dates: 7/1/2021 – 6/30/2024
  Funding: total

- Title: Communication of the International Spinal Cord Injury Exercise Guidelines
  Agency: Craig H. Neilsen Foundation
  Effort: 3.4 CM
  Dates: 04/30/2022-04/29/2025
  Funding: total

What other organizations were involved as partners?
If there is nothing significant to report during this reporting period, state "Nothing to Report."

Describe partner organizations – academic institutions, other nonprofits, industrial or commercial firms, state or local governments, schools or school systems, or other organizations (foreign or domestic) – that were involved with the project. Partner organizations may have provided financial or in-kind support, supplied facilities or equipment, collaborated in the research, exchanged personnel, or otherwise contributed.

Organization Name:	Craig Hospital
Location of Organization:	Englewood, CO
Partner's contribution to the project:	Collaboration
Organization Name:	Louis Stokes Cleveland VAMC
Location of Organization:	Cleveland, OH
Partner's contribution to the project:	Collaboration

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS: Not applicable.

QUAD CHARTS: See below.

9. APPENDICES: Not applicable.

Assistive Technology and Functional Outcomes Following Spinal Cord Injury

Log Number: SC170159

Award Number: W81XWH-81-1-0806

PI: Kimberley Monden, PhD **Org:** University of Minnesota **Award Amount:** $638,083

Study/Product Aim(s)

Aim 1 (Qualitative): To examine perceived barriers to or facilitators of AT access and utilization and the impact on functional and psychosocial outcomes after tetraplegia.

Aim 2 (Quantitative): To assess for variations in use of AT among individuals with tetraplegia across insurance providers and socioeconomic status in veterans and civilians with tetraplegia.

Aim 3a (Quantitative): To assess the relationship between AT use and productivity (employment/school) in veterans and civilians with tetraplegia.

Aim 3b (Quantitative): To assess the relationship between AT and psychosocial outcomes (e.g., mood, self-efficacy) in Veterans and civilians with tetraplegia.

Approach

Mixed methods design with qualitative focus group interviews and quantitative surveys conducted at two study sites (civilian and veteran).

Timeline and Cost

Activities FY	18-19	19-20	20-21	21-22	22-23
IRB, identify subjects, conduct focus groups					
Analyze qualitative data and conduct quantitative data collection					
Analyze quantitative data and prepare manuscript/presentations					
Estimated Budget ($K)	$200,764	$213,366	$223,955	NCE	NE

Achievements: Presentation of Aim 1 qualitative data at national and international conferences. Enrollment of our first LSCVAMC participant in Aim 2 on 12/15/21. Reached a total of 266 participants with complete survey data, which is 87% of our target enrollment. Completed final draft of Aim 1 manuscript.

Goals/Milestones

FY18-19 Goal – Conduct focus groups

✓ Obtain IRB/HRPO approval at both study sites

✓ Conduct focus groups

FY19-20 Goals – Qualitative analysis and quantitative data collection

✓ Analyze qualitative data and develop additional survey items

✓ Conduct quantitative data collection

FY20-21 Goal – Analysis and reporting

☐ Analyze quantitative data and prepare reports/presentations

☐ Develop plans/proposals for future investigations of AT use for veterans and civilians with SCI

Comments/Challenges/Issues/Concerns

A request for a no-cost-extension was submitted and approved.

Budget Expenditure to Date

Actual Expenditure: $603,433.67