AWARD NUMBER: W81XWH-19-1-0798

TITLE: Virtual Reality-Based Assessment of Functional Capacities in Individuals with Alzheimer's Disease or Alzheimer's Disease-Related Dementia

PRINCIPAL INVESTIGATOR: Michael Barnett

CONTRACTING ORGANIZATION: The University of Texas at Tyler

REPORT DATE: OCTOBER 2022

TYPE OF REPORT: Annual

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

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
OCTOBER 2022	Annual	30SEPT2021 - 29SEPT2022

4. TITLE AND SUBTITLE

Virtual Reality-Based Assessment of Functional Capacities in Individuals with Alzheimer's Disease or Alzheimer's Disease-Related Dementia

5a. CONTRACT NUMBER
W81XWH-19-1-0798

5b. GRANT NUMBER

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)

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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
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The primary aim of this project is to pilot the Virtual Environment Grocery Store (VEGS) and Virtual Apartment for use among older adults with cognitive impairment. A related aim is the development and evaluation of computational and statistical models of patient data from the virtual environments that generate reports for caregivers. Our ultimate goal is to provide clinical assessments and clinical feedback to patients that is more meaningful for the lives of aging adults. We will compare measures embedded in the virtual environments with measures obtained from traditional neuropsychological tests. We will compare older adults with Alzheimer's Disease (AD)/Alzheimer's Disease Related Dementia (ADRD) and no history of traumatic brain injury (TBI), those with AD/ADRD and a history of TBI, and healthy controls on both traditional neuropsychological tests and those embedded in the virtual environments. We will gather patient/caregiver feedback regarding the utility of the reports generated by the virtual environments.

15. SUBJECT TERMS
Neuropsychological assessment; virtual reality, Virtual Environment Grocery Store; Virtual Apartment; older adults; Alzheimer's disease; dementia; traumatic brain injury

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			USAMRDC
U	U	U	UU	8	19b. TELEPHONE NUMBER *(include area code)*

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Abbreviations: The University of Texas at Tyler (UTT); Michael Barnett (MB); University of North Texas (UNT); Thomas Parsons (TP)

Specific Aim 1 – The **primary aim** is to pilot the Virtual Environment Grocery Store (VEGS) for use among older adults with TBI and AD/ADRD.	**Time line**	**UTT**	**UNT**	**% Complete**
Major Task 1: Finalize protocols and obtain IRB and USAMRDC HRPO approval	Months			
Subtask 1: Meeting of all key personnel to finalize study protocols for UT Tyler IRB	1	MB	TP	100%
Milestone #1: *Create written protocol for UT Tyler IRB and establish regular meetings*	3	MB	TP	100%
Subtask 2: Meeting of all key personnel to finalize study protocols for USAMRDC HRPO	4	MB	TP	100%
Milestone #2: *Create written protocol for USAMRDC HRPO and submit*	4-8	MB	TP	100%
Subtask 3: Meeting of all key personnel to finalize modifications, if necessary, for UT Tyler IRB	8	MB	TP	100%
Milestone #3: *Create written modification for UT Tyler IRB, based on USAMRDC HRPO feedback, and*	8	MB	TP	

submit to UT Tyler IRB				100%
Major Task 2: *VEGS* content refinement and testing to develop caregiver feedback				
Subtask 1: Storyboard materials and generating example scripts; data logging implemented; plan feedback to caregivers	2-4		TP	100%
Subtask 2: Recruit participants and run them through neuropsychological assessments and VEGS [Total *n* = 20 patients from one of the clinical groups – i.e., with probable AD/ADRD and either with or without TBI – and their caregivers]	5-12	MB		100%
Milestone #2: *Meeting of all key personnel to review VEGS and feedback from caregivers*	13	MB	TP	100%
Specific Aim 2 – The **secondary aims** are to 1) conduct study comparing persons with AD to healthy controls on neuropsychological assessments and VEGS; and 2) assess reaction/satisfaction of caregivers to feedback from the VEGS.				
Major Task 3: Conduct Comparison Study comparing persons with AD to healthy controls on neuropsychological assessments and VEGS				
Subtask 1: Recruit participants for study. Ultimate goal: Healthy older adult controls (*n* = 90), no history of TBI and probable AD/ADRD (*n* = 90), history of TBI and probable AD/ADRD (*n* = 90)	14-30	MB		35%
Subtask 2: Conduct comparison study	14-30	MB		100%
Subtask 3: Database development	14-30	MB	TP	100%
Milestone #3: *Meeting of all key personnel to compile and discuss data gathered*	30	MB	TP	100%
Major Task 4: Comparison Study Data analytics				
Subtask 1: Computational and statistical modeling of data from study	30-		TP	100%

	36			
Milestone #4: *Publish results from Pilot Comparison Study*	30 - 36	MB	TP	100%

Recruitment Table

Quarter	Planned	Screened	Enrolled	Complete
Year 1 Q1	0	0	0	0
Year 1 Q2	18	0	0	0
Year 1 Q3	18	0	0	0
Year 1 Q4	24	1	1	1
Year 2 Q1	24	1	1	1
Year 2 Q2	30	14	14	12
Year 2 Q3	30	0	0	0
Year 2 Q4	33	5	5	5
Year 3 Q1	33	15	15	13
Year 3 Q2	30	13	13	12
Year 3 Q3	30	13	13	11
Year 3 Q4	0	6	6	3
Total	270	68	68	58

Wanting to build off of this research, we have submitted proposals for additional funding.

» 2022. NIH Research Enhancement Award Program (R15). Measuring financial capacity: A smartphone-based approach to identifying older adults at risk of financial exploitation. $441,000.00

» 2022. Department of Defense peer Reviewed TBI Research Program Translational Research Award. Measuring financial capacity: A smartphone-based approach to identifying older adults at risk of financial exploitation.

We also have one manuscript almost ready for submission, and we have had three peer-reviewed abstracts published:

» Barnett, M. D., Chek, C. J. W., Shorter, S. S., & Parsons, T. D. (2022). Comparison of Traditional and Virtual Reality-Based Episodic Memory Performance in Clinical and Non-Clinical Cohorts. *Brain Sciences,* 12(8), 1019. https://doi.org/10.3390/brainsci12081019.

» Parsons, T. D., & Barnett, M. D. (2019). Virtual Apartment-Based Stroop for assessing distractor inhibition in healthy aging. *Applied Neuropsychology: Adult, 26(2), 144-154*. https://doi.org/10.1080/23279095.2017.1373281

» Parsons, T.D., Barnett, M., & McMahan, T. (2020). Assessment of cognitive and functional performance using a Virtual Environment Grocery Store with environmental distractors. *Annual Review of CyberTherapy and Telemedicine*, *18, 157-161*.

» Shorter, S., Coldiron, A., Reed, C., Glover, T., Gutierrez, R., Rodriguez, D., Moore, J., Parsons, T., & Barnett, M. (2020). Comparison of performance on the Virtual Environment Grocery Store and the CVLT-II: A-184. *Archives of Clinical Neuropsychology*, *35*(6). https://doi.org/10.1093/arclin/acaa068.184

» Persin, M. J., Hardesty, D., Lee, D. C., Tran, N., Bayer, C., Childers, L. G., Moore, J. M., Parsons, T. D., & Barnett, M. D. (2021). A-168 Neural network for the Virtual Environment Grocery Store for detection of neurocognitive impairment among older adults. *Archives of Clinical Neuropsychology*, *36*(6), 1223. https://doi.org/10.1093/arclin/acab062.186

» Hardesty, D. R., Chek, C., Persin, M., Barr, E., Sasser, H., Glover, T., Coldiron A., Parsons, T. D., & Barnett, M. D. (2021). A-12 Relationships between performance on the virtual environment grocery store and adaptive functioning among older adults. *Archives of Clinical Neuropsychology*, *36*(6), 1052. https://doi.org/10.1093/arclin/acab062.30

We have also submitted several poster presentations from the study data.

» Griffin, R. A., Guillory, L. A., Hardesty, D. R., Avendano, J. S., Boynton, H. G., Killingsworth, D. C., Morales-Mejia, Y. L., Parsons, T. D., & Barnett, M. D. (Accepted). Premorbid Intellectual Functioning and Not Education Predicts Memory Performance Virtual Environment Grocery Store. The 2023 International Neuropsychological Society, San Diego, CA, United States.

» Hardesty, D.R., Chek, C., Wurm, A., Nabulsi, E., Dube, J., Griffin, R., Avendano, J., Coldiron, A., Parsons, T. D., & Barnett, M. D. (October 2022). The virtual environment grocery store explains variance in older adults' adaptive functioning beyond age. Virtual poster presented at The National Academy of Neuropsychology's 42nd Annual Conference, Denver, CO, United States.

» Persin, M.J., Hardesty, D., Lee, D.C., Tran, N., Bayer, C., Childers, L., Moore, J.M., Parsons, T. D., & Barnett, M. D. Neural network for the Virtual Environment Grocery Store for detection of neurocognitive impairment among older adults. Abstract presented at the National Academy of Neuropsychology 2021 Conference.

» Hardesty D., Chek, C., Persin, M., Barr, E., Sasser H., Glover, T., Coldiron, A., Parsons, T. D., & Barnett, M. D. Relationships between performance on the Virtual Environment Grocery Store and adaptive functioning among older adults. Abstract presented at the National Academy of Neuropsychology 2021 Conference.

» Shorter, S. S., Coldiron, A. M., Reed, C. M., Glover, T. L., Gutierrez, R. M., Rodriguez, D., Moore, J. M., Parsons, T. D., & Barnett, M. D. (2020, October). Comparison of performance on the Virtual Environment Grocery Store and the CVLT-II. Poster presented at the 40th Annual Conference Virtual Edition (due to COVID-19) of the National Academy of Neuropsychology.

» Helphrey, J. H., Sawyer, J. D., Bennett, L. J., Sandlin, A. M., Smith, L. N., Flores, E. V., Parsons, T. D., & Barnett, M. D. (2020, February). A preliminary study of activity level in relation to performance on prospective memory tasks in a virtual environment. Poster presented at the International Neuropsychological Society's 2020 annual meeting in Denver, CO.

» Bennett, L. J., Sawyer, J. D., Coldiron, A. M., Reed, C. M., Flores, E. V., Markey, C. E., Parsons, T. D., & Barnett, M. D. (2020, February). Paces in different places: A preliminary study of the relationship between physical activity and navigation in a virtual environment. Poster presented at the International Neuropsychological Society's 2020 annual meeting in Denver, CO.

4. Impact

We believe that this study will make an impact by piloting two new virtual environments for use among older adults with neurocognitive impairment.

5. Changes/Problems

Since the COVID-19 restrictions ended, we have struggled to regain the ability to recruit participants in the community. We continue to have fewer patients with TBI than initially anticipated. We have received a one-year no-cost extension and hope to be able to run more TBI patients.

6. Products

None

7. Participants & Other Collaborating Organizations

Name: Michael Barnett
Project Role: Principal Investigator
Researcher Identifier: ORCID ID 0000-0002-0571-4884
Nearest person month worked: 2.0
Contribution to Project: The PI oversaw all aspects of the grant. PI supervised the graduate student. PI worked with Co-PI and graduate student in scoring of much of the neuropsychological assessment results gained from the preliminary data collection. PI met regularly with study personnel to develop the database, clean the data, and analyze the data. Given results from the preliminary data collection, the PI supervised and directed refinement of the study protocol and establishment of the report format. An initial paper on preliminary results was started and will continue on into next quarter; this should include both a conference presentation paper and a submission to a peer-reviewed journal.

Name: Thomas Parsons
Project Role: Co-Principal Investigator
Researcher Identifier: ORCID ID 0000-0003-0331-5019
Nearest person month worked: 1.8
Contribution to Project: The co-PI supported PI and graduate student scoring of much of the neuropsychological assessment results gained from the preliminary data collection. Co-PI met regularly with study personnel to develop the database, clean the data, and analyze the data. Given results from the preliminary data collection, the co-PI worked with PI to refine the study protocol and establish the report format. An initial paper on preliminary results was started and will continue on into next quarter; this should include both a conference presentation paper and a submission to a peer-reviewed journal.

Name: Jennifer Sawyer
Project Role: Graduate Student
Researcher Identifier: None Available
Nearest person month worked: .45
Contribution to Project: Ms. Sawyer helped with recruiting and running participants.

8. Special Reporting Requirements

None

9. Appendices

None