12-5-2021

Exploring the Effectiveness of Robotic Exoskeletons in the Acute Care Phase of Acquired Brain Injury Rehabilitation

Renee E. Brooks
Nova Southeastern University, rw1150@mynsu.nova.edu

Exploring the Effectiveness of Robotic Exoskeletons in the Acute Care Phase of Acquired Brain Injury Rehabilitation

Renee Brooks, OTD-S
Nancy Rajan, MS, OTR/L, MA, Lindsay Pearl, MOT, OTR/L, & AdventHealth Connerton

NSU Florida
Tampa Bay Regional Campus
NOVA SOUTHEASTERN UNIVERSITY

Introduction

- Early mobilization of patients with CVAs is safe, feasible, and produces an increased rate of discharges to home (Goldfarb et al., 2021).
- The leading cause of hemiparesis resulting in gait and balance deficits in adolescents and young adults is an acquired brain injury (ABI). Only 60% of patients' post-stroke can ambulate upon discharge from inpatient rehab facilities (Swank et al., 2020 & Lord et al., 2004).
- Presently, wearable lower-limb robotic exoskeletons are emerging innovative technology used to ambulate patients with ABIs requiring varying levels of assistance. Robotic exoskeletons are utilized in rehabilitation to restore gait functionally (Karunakatan et al., 2020).
- The purpose of this project is to explore the effectiveness of robotic exoskeletons on improving functional outcomes of patients in the acute phase of ABI recovery.

Site Description

- AdventHealth Connerton is a 77-bed hospital located in Land O' Lakes, Florida.
- Long-Term Acute Care Hospital (LTACH) that provides wide range of services for patients with medically complex conditions that require extended hospital stays.
- Specializes in ventilator weaning, complex respiratory conditions, infectious diseases, heart failure, post-trauma, renal disorders, surgical complications, complex wound care, and neurological disorders.
- Intensive care unit, progressive care unit, and medical/surgical unit.
- All patients receive daily therapy services alternating between OT and PT daily. SLP services provided to appropriate patients.

Summary of Needs Assessment

- Early mobilization is crucial for patients to make maximum improvement post brain injury (Goldfarb et al., 2021).
- Use of a robotic exoskeleton in the long-term acute care setting will assist in mobilizing patients who require maximum assistance to ambulate.
- AdventHealth Connerton has a lack of equipment to assist in mobilizing patients who require maximal assistance to ambulate.

Literature Review Summary

Evidence-Based Support of Robotic Exoskeletons

- Robotic exoskeletons are relatively new, however there are now companies that have received FDA approval to be utilized on patients with ABIs and CVAs and are becoming more common in acute and inpatient rehabilitation centers.
- A systematic review by Fernandez et al. (2021) revealed robotic exoskeletons demonstrate the most promising results in rehabilitation efficacy over conventional gait therapy in the post-stroke population.
- Karunakaran et al. (2021) found participants walked an increased distance using the robotic exoskeleton in comparison to their sessions with standard gait training.
- A meta-analysis by Moucheboeuf et al. (2020), suggests that exoskeleton robotic training was an efficient intervention tool for gait recovery post stroke when combined with physiotherapy and body weight training.
- Nolan et al. (2020) suggests that robotic exoskeleton training can increase the dosing of gait training on patient's post stroke who require maximum assistance to walk.
- Karanukatan et al. (2020) found improvements after 4 weeks of using robotic exoskeletons on individuals with ABIs on loading and unloading as well as increased step length and speed.

Gap in the Evidence

- Nedergard et al. (2021) found that there is a gap in evidence on the effects of robotic exoskeleton training in patients who are post stroke in comparison to standard gait training.
- Louie and Eng (2016) suggests that patients receive benefits from exoskeleton gait training however it is equivalent to the standard of care in patients with chronic strokes.

Capstone Project Description

The culminating project for this capstone experience was the enhancement of the brain injury program at AdventHealth Connerton. This capstone project and experience was designed to improve outcome measures of patients in the brain injury program and move closer to the goal of receiving accreditation from JCAHO for ABIs. In order to improve the outcome measures, the staff and leadership identified that there is a lack of equipment to assist in ambulating patients with ABIs that require maximal assistance. This capstone project identified the effectiveness of lower-limb robotic exoskeletons for patients with ABIs in the acute stage of recovery, advocated for funding for the facility, provided educational material on brain injuries for staff and families, revised the policy for the brain injury program, and finished the collection and organization of data on patients in the brain injury program for a 4-month period in order to submit to JCAHO at the next review.

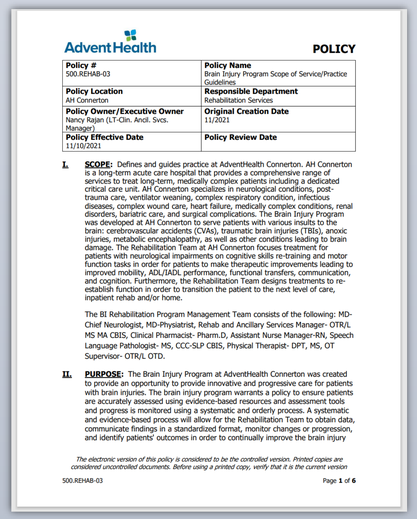
AdventHealth Connerton

Brain Injury Outcome Data 2021

Outcomes Measures	July	August	September	October	Target/ Comparative
Mobility	100%	89%	63%	86%	75%
Communication	80%	89%	89%	86%	70%
Grooming	73%	100%	63%	86%	TBD
Balance	73%	78%	63%	71%	TBD

Analysis of Brain Injury Outcome Data 2021

Outcome data was collected on patients in the brain injury program for a 4-month time span. Inclusion to the brain injury program was that a patient must have sustained a new brain injury and must be functioning below their baseline prior to the brain injury. This data is required by JCAHO in order to receive accreditation for ABIs. This data will also provide the therapy department with quantitative information to advocate for new equipment to assist in improving scores.
The data collected was the quality indicator scores at admission and discharge for mobility, communication, and oral hygiene (grooming), as well as sitting balance score. The number in each box indicated the percentage of patients that improved from the time of admission to discharge. The color of the boxes indicated if the percentage reached the target/comparative from the previous year. Green indicates the outcome percentage is higher than the target comparative and red indicates it is below.



AdventHealth **POLICY**

Policy # 500.REHAB-03	**Policy Name** Brain Injury Program Scope of Service/Practice Guidelines
Policy Location AH Connerton	**Responsible Department** Rehabilitation Services
Policy Owner/Executive Owner Nancy Rajan (LT-Clin. Ancil. Svcs. Manager)	**Original Creation Date** 11/2021
Policy Effective Date 11/10/2021	**Policy Review Date**

I. **SCOPE:** Defines and guides practice at AdventHealth Connerton. AH Connerton is a long-term acute care hospital that provides a comprehensive range of services to treat long-term, medically complex patients including a dedicated critical care unit. AH Connerton specializes in neurological conditions, post-trauma care, ventilator weaning, complex respiratory condition, infectious diseases, complex wound care, heart failure, medically complex conditions, renal disorders, bariatric care, and surgical complications. The Brain Injury Program was developed at AH Connerton to serve patients with various insults to the brain: cerebrovascular accidents (CVAs), traumatic brain injuries (TBIs), anoxic injuries, metabolic encephalopathy, as well as other conditions leading to brain damage. The Rehabilitation Team at AH Connerton focuses treatment for patients with neurological impairments on cognitive skills re-training and motor function tasks in order for patients to make therapeutic improvements leading to improved mobility, ADL/IADL performance, functional transfers, communication, and cognition. Furthermore, the Rehabilitation Team designs treatments to re-establish function in order to transition the patient to the next level of care, inpatient rehab and/or home.

The BI Rehabilitation Program Management Team consists of the following: MD- Chief Neurologist, MD-Physiatrist, Rehab and Ancillary Services Manager- OTR/L MS MA CBIS, Clinical Pharmacist- Pharm.D, Assistant Nurse Manager-RN, Speech Language Pathologist- MS, CCC-SLP CBIS, Physical Therapist- DPT, MS, OT Supervisor- OTR/L OTD.

II. **PURPOSE:** The Brain Injury Program at AdventHealth Connerton was created to provide an opportunity to provide innovative and progressive care for patients with brain injuries. The brain injury program warrants a policy to ensure patients are accurately assessed using evidence-based resources and assessment tools and progress is monitored using a systematic and orderly process. A systematic and evidence-based process will allow for the Rehabilitation Team to obtain data, communicate findings in a standardized format, monitor changes or progression, and identify patients' outcomes in order to continually improve the brain injury

The electronic version of this policy is considered to be the controlled version. Printed copies are considered uncontrolled documents. Before using a printed copy, verify that it is the current version

500.REHAB-03 Page **1** of **6**

Revised policy for the brain injury program.

Learning Objectives Achieved

1. Enhanced the brain injury program by completing the 4-month data collection process, created education for nursing staff, and revised the brain injury practice guideline policy.
2. Demonstrated advanced knowledge and skills to complete the full OT process with medically complex patients in the long-term acute care setting.
3. Explored evidence on the effectiveness of robotic exoskeletons to utilize with patients in the acute phase of ABI recovery.
4. Developed competence in advocating for funding, creating grant proposals, and exploring the need for new pieces of equipment.

Implications for OT Practice

Implementation of this capstone project has provided AdventHealth Connerton with:

- Evidence on the effectiveness of robotic exoskeletons during the acute phase of ABI recovery.
- Completed and organized data to submit to JCAHO, proposal for funding for new equipment, educational material on facilitating recovery in patients with brain injuries, and a revised policy for the injury program guidelines to guide therapy staff.
- This project will improve occupational performance of patients with ABIs by advocating for innovative equipment which will help improve tolerance to the upright position during functional activities, improve outcome scores, and reduce bed-associated complications.

This project will be sustained by the staff at AdventHealth Connerton and is still in its early phases in developing the brain injury program. Furthermore, there are opportunities for future students to continue to contribute and enhance the existing brain injury program at AdventHealth Connerton.

References & Acknowledgements

My deepest appreciation goes to Nancy Rajan, MS, OTR/L, MA, CBIS and Lindsay Pearl, MOT, OTR/L for their meaningful support and guidance that contributed to the completion of this capstone project.

References Available Upon Request