



2017

An Assistive Technology Manual to Enhance Occupations During Stages of ALS: A Manual for Occupational Therapists and Caregivers

Warren Ross
University of North Dakota

Marcus Sickler
University of North Dakota

Follow this and additional works at: <https://commons.und.edu/ot-grad>

 Part of the [Occupational Therapy Commons](#)

Recommended Citation

Ross, Warren and Sickler, Marcus, "An Assistive Technology Manual to Enhance Occupations During Stages of ALS: A Manual for Occupational Therapists and Caregivers" (2017). *Occupational Therapy Capstones*. 369.
<https://commons.und.edu/ot-grad/369>

This Scholarly Project is brought to you for free and open access by the Department of Occupational Therapy at UND Scholarly Commons. It has been accepted for inclusion in Occupational Therapy Capstones by an authorized administrator of UND Scholarly Commons. For more information, please contact zeinebyousif@library.und.edu.

AN ASSISTIVE TECHNOLOGY MANUAL TO ENHANCE OCCUPATIONS DURING
STAGES OF ALS

by

Warren Ross, MOTS & Marcus Sickler, MOTS

Advisor: Julie Grabanski, Ph.D., OTR/L

A Scholarly Project

Submitted to the Occupational Therapy Department

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Occupational Therapy

Grand Forks, North Dakota

May

2017

Copyright 2016 Warren Ross & Marcus Sickler

APPROVAL PAGE

This Scholarly Project Paper, submitted by Warren Ross, MOTS and Marcus Sickler, MOTS in partial fulfillment of the requirements for the Degree of Master of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisor under whom the work has been done and is hereby approved.



Signature of Faculty Advisor

04/10/17
Date

PERMISSION

Title An assistive technology manual to enhance occupations during stages of ALS

Department Occupational Therapy

Degree Master of Occupational Therapy

In presenting this Scholarly Project in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, we agree that the Department of Occupational Therapy shall make it freely available for inspection. We further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised our work or, in her absence, by the Chairperson of the Department. It is understood that any copying or publication or other use of this Scholarly Project or part thereof for financial gain shall not be allowed without our written permission. It is also understood that due recognition shall be given to us and the University of North Dakota in any scholarly use which may be made of any material in our Scholarly Project Report.

Signature Warren Ross

Date 4-12-17

Signature Marcus Sibley

Date 4-12-17

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	vi
ABSTRACT.....	vii
CHAPTER	
I. INTRODUCTION.....	1
II. REVIEW OF LITERATURE.....	7
Amyotrophic Lateral Sclerosis Overview.....	7
Role of Occupational Therapy.....	12
Ecology Model of Human Performance.....	19
III. METHODOLOGY.....	26
IV. PRODUCT.....	29
V. SUMMARY.....	176
REFERENCES.....	179

ACKNOWLEDGEMENTS

We would like to extend a warm thanks to our family, friends, and the UND faculty/students who have been supportive over the past three years in the Occupational Therapy Program. We would also like to express a special thanks to our scholarly project advisor Julie Grabanski, Ph.D., OTR/L, for her expertise, guidance, and patience throughout the making of this manual. This has been an exciting journey that has prepared us for a successful career in occupational therapy.

ABSTRACT

Title: *Assistive Technology to Enhance Occupations during Stages of ALS*

Authors: Warren A. Ross, Marcus A. Sickler, Dr. Julie Grabanski.

Institution: Department of Occupational Therapy, University of North Dakota School of Medicine & Health Sciences, 1301 North Columbia Road, Grand Forks, ND 58203

Purpose: The purpose of this project was to develop a manual for occupational therapists and caregivers that provides assistive technology suggestions to address the needs of an individual with ALS at each stage of the disease.

Methods: An extensive literature review was completed on ALS and assistive technology to examine the effects of ALS, course of progression of the disease, variations of the disease, and signs and symptoms. Multiple online databases were utilized including: CINAHL, PubMed, PsycINFO, Academic Search Premier, Google Scholar, and OT search. Further literature reviewed included current assistive technology individuals with ALS found useful related to communication, mobility, and leisure engagement.

Results: The ALS assistive technology manual was created based on the Ecology of Human Performance Model of Occupational Performance for OT practitioners. The product, *Assistive Technology to Enhance Occupations during Stages of ALS*, provides the OT and caregiver with information related to ALS and the progression of the disease throughout the areas of communication, mobility, home modification, and leisure engagement.

Conclusion: The manual was created for practicing occupational therapists, other members of the health care team, and caretakers of individuals with ALS. The manual is not inclusive of all assistive technology (AT) options throughout the areas of communication, mobility, home modifications, and leisure engagement, but provides a comprehensive list of common and researched AT to increase performance range within the individual.

CHAPTER I

INTRODUCTION

Amyotrophic Lateral Sclerosis (ALS) impacts approximately 20,000 individuals in the United States in any given year (Fried-Oken et al., 2006). ALS is considered one of the most frequently diagnosed motor neuron diseases within the United States (Arbesman & Sheard, 2014). ALS, also known as Lou Gehrig's disease is defined as an idiopathic, fatal neuromuscular degenerative disease that progressively degenerates muscle integrity throughout the majority of the body, and eventually causes paralysis and respiratory failure (Kiernan et al., 2011). There is currently no cure for ALS and the disease progresses rapidly and in a curvilinear fashion. The median survival rate after diagnosis is approximately 3 years with the most common causes of death stemming from pneumonia, pulmonary failure, or cardiac arrhythmias (Arbesman & Sheard, 2014). Roughly 10% of individuals diagnosed with ALS live 10 years post diagnosis (Arbesman & Sheard, 2014). From a healthcare perspective, there are currently no options for remediation of symptoms associated with the disease. Since remediation is not an option, more emphasis is placed on adaptation and compensation.

Due to the nature of the disease, the profession of occupational therapy (OT) has a unique responsibility to provide interventions that aim to help individuals with ALS remain as independent as possible throughout all aspects of their lives. The lifetime incidence risk for developing ALS is approximately 1 per 400 for females and 1 per 350 for men, or 3 per 100,000 per year for men and 2 per 100,000 per year for woman (Kiernan et al., 2011). These statistics

indicate that ALS is considered a rare disease, but prevalent throughout the United States nonetheless due to the drastic and swift health implications associated with the disease.

There are resources available that may help an individual or clinician to choose various types of assistive technology that may be appropriate for an individual with ALS. However there are currently no manuals available specific to assistive technology (AT) to increase independence with community mobility, communication, and engagement in leisure activities from an occupational therapy perspective. A manual that provides evidence-based information related to AT and individuals with ALS is critical due to the rapid and debilitating progression of the disease.

Part of the OT role is to assess the individual's various roles, occupations, and the environment in which these roles and occupations take place, in order to increase functional independence through a variety of intervention approaches including: create/promote, establish/restore, alter, modify/adapt, and prevent. When working with individuals diagnosed with ALS, occupational therapists typically use interventions that focus on restoring previous abilities, adapting/modifying methods of completion, and preventing further loss of occupational enjoyment. The authors chose to focus on the middle adult population for this project. The authors chose this specific population due to the average age of onset corresponding with ALS. Individuals are at the highest risk of developing the sporadic variation of ALS between the ages of 58-63 with an average age of onset at 60 years (Kiernan et al., 2011). Individuals are at the highest risk of developing the familial variation of ALS between the ages of 47-52 with an average age of onset at 49 years (Kiernan et al., 2011).

During the middle adult stage of life, an individual is potentially retired, financially stable, well established in their routines, occupations, and social group, and possesses the

freedom to fully participate in their desired occupations. A diagnosis of ALS during this stage of life greatly diminishes the freedom and autonomy associated with middle adulthood. The role of the OT is not always clearly described when working with individuals diagnosed with ALS due to the varying and case-by-case style of the disease. Evidence shows that use of various types of AT and can greatly increase functional independence in functional mobility, communication, and leisure participation for individuals diagnosed with ALS (Fried-Oken et al., 2006).

The purpose of this scholarly project was to develop a manual for occupational therapy practitioners and other potential caregivers to address AT use among individuals with ALS in order to optimize participation in functional mobility, communication, and leisure participation. The manual is intended to be applied by OT practitioners and other potential caregivers who work with this specific population. The authors created a manual in order to ease the decision making process relative to various AT for individuals with ALS entitled *An Assistive Technology Manual to Enhance Occupations During Stages of ALS*. The manual included a description of the types and symptomatology to expect throughout the progression of ALS and AT that is evidence-based and appropriate to increase independence in regard to communication, functional mobility, and participation in leisure activities. The development of the project was guided by the Ecology of Human Performance (EHP) model (Turpin & Iwama, 2011). This model considers the unique relationship between the person, the tasks the person wants or needs to accomplish, and the context in which these tasks take place (Turpin & Iwama, 2011). A foundational concept of the EHP model is that the relationship between the person and their environment is viewed as interdependent (Turpin & Iwama, 2011). This means that the tasks a person engages in are enmeshed within the overall context in which they take place.

This model focuses on increasing the individual's performance range or the amount of tasks/activities they are able to complete, taking into account their personal skills and abilities, as well as, the context of the tasks/activities (Turpin & Iwama, 2011). In regard to this project, the *person* is the individual diagnosed with ALS (47-63 years) who is expected to be enmeshed within the contexts associated with communication, functional mobility, and leisure participation. *Context* is unique to the EHP model, as it addresses the cultural, social, temporal, and physical aspects in which a person interacts. Context is viewed as dynamic rather than static and it is influenced by the individual as much as the individual is influenced by it (Dunn, Brown, & McGuigan, 1994).

The following chapters of this scholarly project are structured for the reader, providing insight into the progression of ALS and AT proven to increase independence in three specific domains of occupation. Chapter II supplies a review of literature on ALS related to types, diagnostic criteria, progression (stages), epidemiology, and effective AT to increase performance with communication, leisure participation, and functional mobility. The activities and methodology utilized to facilitate the review of literature and create the AT manual are covered throughout Chapter III. Chapter IV provides the reader with an AT manual, *An Assistive Technology Manual to Enhance Occupations During Stages of ALS*, to aid in the AT decision making process for individuals diagnosed with ALS. Lastly, Chapter V summarizes the purpose and contains a brief overview of the project, recommendations for implementation of the product and limitations.

Key Terms & Definitions:

ALS Types:

- *Charcot's or spinal ALS* is the most classic form of ALS and patients often initially present with focal muscle weakness beginning either proximally or distally (Wijesekera & Leigh, 2009).
- *Progressive bulbar palsy or Bulbar ALS* is the second most common form of ALS and patients often initially present with speech dysarthria (Wijesekera & Leigh, 2009).
- *Progressive muscular atrophy as known as Duchenne-Aran muscular atrophy* is a subtype of motor neuron disease that affects only the lower motor neurons (Wijesekera & Leigh, 2009).
- *Flail arm or Vulpian-Bernhardt syndrome* is a rare form of ALS that is characterized by progressive proximal weakness of the upper extremities, does not involve the lower extremities, bulbar, or respiratory muscles (Wijesekera & Leigh, 2009).
- *Primary lateral sclerosis* is a rare form of ALS that affects only the upper motor neurons and presents with weakness throughout voluntary muscles (Wijesekera & Leigh, 2009).
- *Flail leg or Pseudo-polyneuritic syndrome* is a rare form of ALS involving the lower motor neurons that is characterized by progressive proximal weakness of the lower extremities (Wijesekera & Leigh, 2009).

Ecology of Human Performance (EHP) Intervention Strategies:

- *Establish/restore* approach is designed to alter client characteristics in order to develop an ability that has yet to be developed or restore an ability that has been impeded (Dunn et al., 1994).

- ***Create/promote*** approach is established to provide enhanced contextual and task experiences that will ultimately increase performance for any individuals in the organic life context (American Occupational Therapy Association, 2014).
- ***Modify*** approach is designed to develop ways to revamp the current context or task demands to enhance performance in the individual's natural setting (Dunn et al., 1994).
- ***Prevent*** approach is designed to adhere to the needs of individuals who may or may not have any disability, but are at risk performance capacity issues (Dunn et al., 1994).

Context:

- ***Cultural context*** refers to beliefs, customs, patterns of activity, standards of behavior, and societal expectations within which an individual identifies (AOTA, 2014).
- ***Physical context*** refers to geographic terrain, plants, and animals, as well as sensory qualities of the surroundings; it also refers to buildings, furniture, tools and devices (AOTA, 2014).
- ***Social context*** refers to the presence of, relationships with, and expectations of person, groups, and populations with whom the clients have contact (AOTA, 2014, p. S45)
- ***Temporal context*** refers to the time of day, time of year, stage of life, history, and tempo or duration of task (AOTA, 2014).

Assistive Technology:

- ***Assistive Technology:*** equipment, services, and approaches to alleviate the issues dealt with by individuals who have disabilities. (Cook & Polgar, 2015).

CHAPTER II

REVIEW OF LITERATURE

Introduction

Amyotrophic Lateral Sclerosis (ALS) is a degenerative neuromuscular disease that progressively degrades muscle integrity throughout the entire body (Schettini, Riccio, Simione, Liberati, Caruso, Frasca,... and Cincotti, 2015). Individuals diagnosed with ALS experience a decrease in the ability to engage in activities that are meaningful to them and complete activities of daily living (ADL). A literature review was conducted on assistive technology available for use throughout the progression of ALS to increase functionality with communication, community mobility, and leisure activities. Assistive technology (AT) is defined as devices, services, strategies, and practices that are conceived and applied to improve the problems faced by individuals who have disabilities (Cook & Polgar, 2015). Assistive technology can be classified into different categories such as soft versus hard technology and low versus high technology (Cook & Polgar, 2015). Soft AT refers to the human interaction or advice and training a therapist is able to offer an individual, while hard AT refers to any actual piece of equipment (Waldron & Layton, 2008). While that may be a bit of grey area along the continuum, low technology refers to equipment that is easy to make and obtain and high technology is difficult to create and obtain (Cook & Polgar, 2015). The research conducted provided various types of hard and soft and low and high versions of assistive technology. The research also found assistive technology that previous individuals diagnosed with ALS found useful to enhance their

participation and functionality relative to aspects of communication, community mobility, and leisure activities.

Overview

Amyotrophic Lateral Sclerosis is considered an idiopathic, fatal neuromuscular degenerative disease (Kiernan et al., 2011). The cause of ALS is currently unknown, which indicates the need for further research on the topic (Arbesman & Sheard, 2014). Based on the research gathered there are a variety of different types of ALS. Confirming a diagnosis of ALS can be a very difficult, extended, and an emotionally draining experience. At the present time in the medical field there are no concrete diagnostic assessments or biomarkers that indicate the presence of ALS (Kiernan et al., 2011).

The type of ALS diagnosis may give insight as to the progression of the disease and specific symptomatology that can be expected. While there is no known cure for this progressive and degenerative disease, there are therapeutic options available to assist with optimizing functionality in the lives of any individuals diagnosed with ALS (Ball, Anderson, Bilyeu, & Pattee, 2007). Generalized weakness, atrophy, and eventually paralysis are common symptoms associated with ALS (Fried-Oken et al., 2006). Individuals diagnosed with ALS often present with speech and mobility issues as well (Spataro, Ciriaco, Manno, & La Bella, 2013). While there is no option for remediation of these symptoms, most individuals benefit from the use of various augmentative and alternative communication (AAC) and other forms of assistive technology (Gruis, Wren, & Huggins, 2011).

Epidemiology

Amyotrophic Lateral Sclerosis is considered a rare disease, but prevalent around the world nonetheless due to its drastic and swift health implications. The most recent research

specifies that symptomology progression in ALS is not linear, rather curvilinear, with the swiftest rate of deterioration occurring during the early and later stages of the disease (Arbesman & Sheard, 2014). The incidence rate of ALS is currently recorded at approximately 2 people per 100,000 per year or about 5 people per 100,000 on a population basis (Wijesekera & Leigh, 2009). Amyotrophic Lateral Sclerosis impacts approximately 20,000 individuals in the United States in any given year (Fried-Oken et al., 2006). ALS is one of the most frequently diagnosed motor neuron disease within the United States (Arbesman & Sheard, 2014). The chances of receiving an ALS diagnosis varies depending on sex.

On average, males have a heightened incidence rate of developing ALS. The lifetime incident risk for developing ALS is approximately 1 per 400 for females and 1 per 350 for men, or 3 per 100,000 per year for men and 2 per 100,000 per year for woman (Kiernan et al., 2011). The overall male to female ratio is 1.5:1 (Wijesekera & Leigh, 2009). Individuals are at the highest risk of developing the sporadic variation of ALS between the ages of 58-63 with an average age of onset at 60 years (Kiernan et al., 2011).

Individuals are at the highest risk of developing the familial variation of ALS between the ages of 47-52 with an average age of onset at 49 years (Kiernan et al., 2011). Research shows that approximately 5-10% of ALS cases are familial based on a Mendelian sequence of inheritance, and the remaining 90% of cases are sporadic (Wijesekera & Leigh, 2009). The chances of developing ALS decrease drastically after approximately 80 years of age (Kiernan et al., 2011). The median survival rate after diagnosis is approximately 3 years with the most common causes of death stemming from pneumonia, pulmonary failure, or cardiac arrhythmias (Arbesman & Sheard, 2014). Roughly 10% of individuals diagnosed with ALS live 10 years post diagnosis (Arbesman & Sheard, 2014).

Types

Amyotrophic Lateral Sclerosis is a term commonly used to refer to a whole spectrum of neuromuscular degenerative disorders characterized by continual degradation of motor neurons. Motor neuron disease (MND) is a term frequently used to describe the ALS spectrum of dysfunction (Kiernan et al., 2011). From a clinical standpoint, the term ALS is generally used to describe Charcot's or spinal ALS, which is the most classic form of the disorder. Other conditions related to this spectrum of disorders include, Progressive Muscular Atrophy, Progressive Bulbar Palsy or bulbar onset, Flail arm or Vulpian-Bernhardt syndrome, Primary Lateral Sclerosis, and Flail leg or Pseudo-polyneuritic syndrome (Wijesekera & Leigh, 2009).

All forms of the disease are similar from a molecular and cellular perspective in that they all essentially result in motor neuron disintegration (Wijesekera & Leigh, 2009). The primary appearances of ALS typically include, Limb-Onset ALS, bulbar onset ALS, Primary Lateral Sclerosis, and Progressive Muscular Atrophy resulting from primarily lower motor neuron involvement (LMN) (Kiernan et al., 2011). Limb-Onset ALS typically presents with both upper motor neuron (UMN) and lower motor neuron involvement throughout the limbs (Kiernan et al., 2011). The bulbar onset version of ALS typically presents with swallowing and speech deficits and limb dysfunction as the disease progresses. The Primary Lateral Sclerosis version of ALS involves primarily the UMN, while the Progressive Muscular Atrophy type involves primarily the LMN.

When deciding what types of assistive technology are most appropriate for an individual it is important to know the common symptomology associated with that individual's specific form of ALS. If the individual presents with a form of ALS that initially produces speech difficulty, a form of assistive technology that helps with speech production would be appropriate.

Depending on the level and progression of their speech disability, that individual may require a low assistive technology device or a high assistive technology device. If the individual presents with a form of ALS that initially produces limb weakness, a form of assistive technology that aids in mobility or leisure participation may be more appropriate. Again, depending on the level and progression of their limb weakness they may require a low assistive technology device or a high assistive technology device.

If the individual presents with a form of ALS that primarily presents with upper extremity weakness, it is logical to assume their assistive technology needs would be tailored towards assisting with upper extremity needs. On the contrary, if the individual presents with a form of ALS that initially weakens their lower extremity function, the AT focus shifts to assist with lower extremity function. An individual can select appropriate AT if they know which type they are dealing with since all types of ALS progress at a different rate. Overall, the form of ALS that an individual has will produce varying symptomatology and rates of progression, thus guiding their specific AT needs.

Diagnostic criteria

There are no known diagnostic tests for healthcare professionals to give a clear-cut definition of ALS (Kiernan et al., 2011). Unfortunately, with the complications associated in diagnosing ALS, the diagnostic process can be long delayed with an average diagnostic time span of approximately 14 months (Kiernan et al., 2011). The clinical features that an individual presents with may vary depending on which type of ALS they are experiencing. Individuals with the most common form of ALS (classical Charcot ALS or spinal onset) usually display symptoms correlated with central muscle weakness stemming either proximally or distally within both upper and lower extremities (Wijesekera & Leigh, 2009).

Some individuals may present with less common sinister symptomatology such as asymmetrical muscle wasting, sporadic paraparesis, muscular cramps, bladder dysfunction, sensory issues, cognitive impairment, or involuntary muscle spasms (Kiernan et al., 2011). Eventually individuals with spinal onset ALS will begin to present with speech dysarthria, which is commonly associated with the bulbar onset variety of ALS (Wijesekera & Leigh, 2009). Individuals presenting with the bulbar onset form of ALS typically display symptomatology correlated with speech dysarthria. Dysphagia is a less common symptom associated with this type of ALS. A high percentage of individuals with this form of ALS also present with sialorrhoea, emotional instability, and excessive yawning (Kiernan et al., 2011). A very small percentage (5%) of individuals initially display pulmonary insufficiencies without other common associated symptoms (Wijesekera & Leigh, 2009).

Role of Occupational Therapy

According to the Occupational Therapy Practice Framework Domain and Process (3rd ed.) occupational therapy is defined as “the therapeutic use of everyday life activities (occupations) with individuals or groups for the purpose of enhancing or enabling participation in roles, habits, and routines in home, school, workplace, community, and other settings” (American Occupational Therapy Association, 2014). Occupational therapy practitioners use their knowledge of the transactional relationship between people, occupations, and context to develop occupation based intervention plans that extend the range of tasks available to an individual and promote successful participation in meaningful activities. Occupational therapy services include habilitation, rehabilitation, and promotion of health and wellness for a broad range of populations.

An occupational therapist can play a large role in treating an individual with ALS. The progression of treatment provided by an occupational therapist will be different depending on the patient because ALS not being a linear progressing disease (Arbesman & Sheard 2014). This means that the timeframe for providing certain types of education and treatment may be different from patient to patient, i.e. an occupational therapist may provide wheelchair recommendations to a client at 6 months post diagnosis for one patient and 8 months post diagnosis for another.

The main goal of occupational therapy when treating an individual with ALS is to maintain independence in activities of daily living, and functional mobility. In order to achieve these goals an individual with ALS may need assistive technology, modifications, education, and exercise. In order to maintain independence with dressing, an occupational therapist may prescribe assistive equipment. Assistive technology can include both high technology options and low technology options. Low technology options for patients with ALS include but are not limited to, reachers, dressing sticks, long handled shoe horns, long handled sponges, button hooks, shower seats, universal cuffs, large diameter utensils, and light weight drinking cups. These devices have been shown to minimize energy output and improve function with self-care for patients with neuromuscular disease (Lewis & Rushanan, 2007). When an individual with ALS needs assistance to transfer from one surface to another, a caregiver may need to be provided with a gait belt, a sliding board, or a mechanical lift. Weak wrist extension will eventually become a challenge for individuals with ALS, thus impairing a patient's ability to grasp everyday objects. An occupational therapist can provide a patient with a wrist cock-up splint to improve function, reach and grasp for an individual with this impairment (Lewis & Rushanan, 2007).

For an individual with ALS, ambulation may become impossible or very fatiguing which is why wheelchairs are a very important piece of technology. When an individual needs a wheelchair, their occupational therapist will play a large role in recommending a wheelchair, features, and home and community modifications. Due to the average lifespan of a patient post diagnosis, and insurance types and policies, an individual with ALS often only gets one wheelchair every five years. . An occupational therapist will make recommendations for the type of wheelchair, and features such as, seating, tilt-in-space, elevating leg rests and other supports (Lewis & Rushanan, 2007). They may also recommend a ramp at the patient's home to allow the patient access to their house. An occupational therapist may also recommend moving furniture; switch rooms, etc. for home modifications in order to make life easier for the patient and their caregivers (Lewis & Rushanan, 2007). Depending on the level of involvement, an occupational therapist may also recommend vehicle modifications in order to allow the patient to get around in their community. An occupational therapist may recommend a wheelchair accessible van, hand controls, swing out seating, etc. to allow for greater function in the community.

Beginning in the early stages and throughout the course of the disease, an occupational therapist will also be involved in talking with the patient and caregivers about any psychosocial or cognitive concerns. An occupational therapist can provide programming to help patients and caregivers deal with certain psychosocial or cognitive difficulties that a diagnosis of ALS can bring. Individuals with ALS can experience cognitive deficits in the form of executive processing and in some cases memory impairment. (Abrahams, Goldstein, Al-Chalabi Pickering, Morris, Pasingham, Brooks, & Leigh, 1997). Difficulties with executive processing impacts, impulsivity, problem solving, planning, and attention (Lewis & Rushanan, 2007). Occupational therapists will also provide programming to a patient or caregiver in energy conservation

techniques, in order to manage fatigue, and exercise in order to help the patient remain as independent as possible for as long as possible. This will also help manage any pain they may experience.

Communication

Social participation often involves communicating with others in a variety of environments. Individuals that experience ALS often have difficulty with verbal communication as they progress through the disease. In 75-95% of individuals, verbal communication becomes impossible (Brownlee & Bruening, 2012). Brownlee and Bruening, (2012) found that 73% of communication in the late stage of ALS involved communication of physical needs between the individual and caregiver. They also found that pain was communicated 32% of the time. There are several low technology options for an individual that experiences deficits in verbal communication, including gestures, signs, or facial expressions, paper-pencil, and communication boards (Francis, Bach, & DeLisa, 1999). There are also several high technology communication options available including, brain-computer interface communication, computers, iPads, and voice output messages (Nijboer, Sellers, Mellinger, Jordan, Matuz, Furdea,... and Kubler, 2008; Servilio & Mazzone, 2012).

In order to determine the most appropriate assistive technology for social participation, context must be considered. If the user is in a time crunch, they may want a simple and quick form of communication such as a low technology picture board or preprogrammed phrases through an electronic device. If time is less of a factor the individual may want to be able to fine-tune their responses more thoroughly through some type of text to speech application. If the user is meeting with someone for the first time, they may want to be more concise and in control of their speech and again may want to use some variation of a text to speech application. If the user

is in a group of familiar friends, a more simple form of communication such as a picture board, or preprogrammed phrase in an electronic device may suffice.

Low technology options may be best suited for environments that are more familiar (Cook & Polgar, 2015). For example, an individual may use gestures, letter boards or signs when communicating with a loved one/caregiver at home. When the same individual is with a larger group or in a public environment, such as a restaurant, they may resort to higher technology options so that anyone, not only their loved one/caregiver, can understand what they are communicating. As a patient progresses through the stages of ALS, the type of communication technology will change. When an individual is in the early stage of the disease, they may only use a letter board, signs, or gestures as a method of energy conservation. As they transition to the later stages of the disease, they may become more dependent on higher communication technology.

In a study conducted by Nijboer, et al., (2008), a brain computer interface proved to be highly effective for communication with individuals that are severely paralyzed by ALS. The ability to use the interface lasted more than 40 weeks for individuals in the study, after initial training. There are several apps that can be downloaded onto an iPad that can aide in communication. One such app is called Proloquo2Go. This app offers text to speech, phrases, communication boards, and picture boards among several other features (Servilio & Mazzone, 2012).

Community Mobility

Community mobility plays a large part in social participation, leisure, and a sense of competence and overall independence (Ward, Hammond, Holsten, Bravver, & Brooks, 2015). A lightweight wheelchair can be used to enhance energy conservation when in the early stage of

the disease (Francis, Bach, & DeLisa, 1999). An occupational therapist will need to carefully consider all possible options when recommending a wheelchair for use during later stages of the disease. Improper modifications can lead to contractures, skin breakdown, pain, lack of independence and a lack of social participation (Francis, Bach, & DeLisa, 1999).

In a study conducted by Ward, Sanjak, Bravver, Williams, Nichols, & Brooks, (2010), the average time from initial onset of symptoms to a power wheelchair (PWC) was 44.69 months with a median of 36 months. This timeframe for the need of a PWC is supported by Bromberg, Brownell, Forshew, & Swenson, (2010) who found that 63% of ALS patients needed a wheelchair after 73-78% of their disease progression. The authors also found that 63% of PWCs chosen were a mid-wheel drive and 38% were front wheel drive. The most commonly ordered features include, tilt, recline, power elevating legs, seat elevator, upgraded electronics, soft headrest, seat functions controlled via joystick, air cushion or foam/gel cushion, flat armrests or armrests with contour, contoured backrest, seat belt, switches for on/off/mode, and attendant control (Ward et al., 2010). The primary uses of a PWC include mobility, pressure relief, positioning assistance, and comfort (Ward et al., 2010). The average cost for a PWC in 2010 was \$27,800 (Bromberg, Brownell, Forshew, & Swenson, 2010). In a study conducted by Ward, Hammond, Holsten, Bravver, & Brooks, (2015) 81% of ALS patients found their PWC to be comfortable and 88% stated that their overall mobility had improved while 95% stated that they found the PWC easy to use after one month of use. After 6 months of use, several patients reported that their quality of life had increased while their pain had decreased (Ward et al., 2015).

Due to the average lifespan of a patient post diagnosis and types of insurance policies, an individual with ALS often only gets one wheelchair once they need it. Individuals with ALS

spend 11-15 hours a day in their PWC (Ward et al., 2010). This means that they are in a PWC in most of the environments they interact with on a daily basis. Since the PWC will be in a wide variety of environments throughout an individual's day, it is important to think about home and vehicle modifications so that a patient with ALS can fully engage in their community.

Leisure

Leisure plays an important part in everyone's lives. However, for individuals with ALS it can become increasingly difficult to participate in leisure activities. Leisure is defined as a, "non-obligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care, or sleep" (OTPF, 2014). For individuals with ALS, participation in leisure is often limited by physical deficits, however it can also be limited by cognitive and communication deficits. (Blacker, Broadhurst, and Teixeira, 2008). Barriers in the physical environment often include, lack of choice and lack of capacity to perform certain tasks.

Cahil, Connolly, & Stapleton (2010) found that women with Multiple Sclerosis (MS) were able to engage in sedentary leisure activities when symptoms were exacerbated. These activities included reading, watching TV, and using the computer. Cahil et al., (2010) also found that women with the progressive type of MS had greater difficulty with adapting to leisure activities and other personal functions as their disease progressed.

ALS is similar to progressive Multiple Sclerosis in the regard that the symptoms become worse as the disease progresses. In order to address the loss of control in one's environment and ability to participate in sedentary leisure, research is being conducted to develop and assess eye tracking communication devices and brain-computer interfaces (Lancioni, Simone, DeCaro, Singh, O'Reilly, Sigafos, Ferlisi, Zullo, Schirone, Denitto, & Zonno, 2015). Lancioni, et al.,

(2015) found that the use of eye movement or touch micro switches were effective for individuals in the later stage of ALS for sedentary leisure exploration. The sedentary leisure activities included, listening to music, television, videos, books and articles as well as communicating with others through text messages.

Leisure activities can occur in a variety of physical, cultural, temporal, and social contexts. For an individual with ALS engaging in leisure activities in the same capacities that they did prior to diagnosis is incredibly challenging. Unfortunately, there is not a lot of research on the types of devices available for more active forms of leisure, such as fishing or biking. There is more research on sedentary leisure activities such as reading or surfing the web. It is because of this gap in the research that we chose to include this part of daily life into the manual.

Ecology of Human Performance

The Ecology of Human Performance (EHP) model will help guide the creation of this manual. The interactions between the person and the environment and the ultimate effect on human behavior and performance is highlighted in this model (Turpin & Iwama, 2011). The overall goal of the EHP model is to expand the performance range available to an individual. For a person with ALS the ability to participate in a variety of tasks will slowly start to deteriorate as the disease progresses. By following the (four important constructs of the EHP) model to guide creation of this manual an individual who experiences ALS will be able to participate in several meaningful tasks for as long as possible.

The EHP model uses the term tasks rather than occupations to describe objective sets of behavior required for attainment of a specific goal (Turpin & Iwama, 2011; Dunn et al., 1994). The ability to accomplish tasks is related to the individual's unique performance range. The performance range refers to the ability to complete tasks. The use of AT in this manual aims to

increase the performance range of individuals with ALS in regard to leisure participation, communication, and functional mobility. The EHP model focuses on increasing the individual's performance range, thus increasing their overall independence and quality of life (Turpin & Iwama, 2011). There are four core constructs in the EHP model, the person, task, context, and performance, (Dunn, Brown, & Youngstrom, 2003). The terminology found in the EHP model differs from that found in other occupational therapy practice models. In the EHP model, task and context are used instead of occupation and environment (Brown, 2009).

Context is the first construct of the EHP model. The assumptions of context are as follows; the context expands beyond the physical environment, the context has the capacity to shape task performance, and the context is expanded to include physical, temporal, social, and cultural elements (Turpin & Iwama, 2011). Social context is divided into two different groups, microsocietal and macrosocietal factors (Dunn et al., 2003). Microsocietal factors include family, friends, coworkers, neighbors, caregivers and churches. Macrosocietal factors include economic organizations, government /political systems, health services, educational services, and businesses (Dunn et al., 2003). This expanded definition of context emphasizes the interrelatedness of person, task, and performance. This expanded definition can help any medical professional better see the relationship between a person, task, and performance.

Person is the second construct of the EHP model. The assumptions that the EHP model makes about the person are as follows, the person is seen as unique and complex and personal variables influence uniqueness of the person. The person variables include values, interests, experiences, and sensorimotor, cognitive, and psychosocial skills. According to Dunn, Brown, and McGuigan (1994), the only way to see the person is through the context because the context influences the selection of the task and the quality of the task performance.

Task is the third construct of the EHP model. The EHP model assumes that there are a multitude of tasks available to a person. However, person and context variables limit the performance range of available tasks to an individual (Turpin & Iwama, 2011). Tasks can be organized into a group that forms a person's roles. The meaning and performance of these roles are influenced by the cultural context of an individual.

The fourth and final construct of the EHP model is performance. Performance can be defined as the interaction between the context, person, and task. Performance is the range of tasks that a person can perform. The overall goal of the EHP model is to increase this performance range of tasks within the context available to the person.

The EHP model is also unique from other occupational therapy models in that it includes five categories for therapeutic intervention. These categories include establish/restore, alter, adapt/modify, prevent, and create/promote (Dunn, Brown, & Youngstrom, 2003). Establish/restore is the development or repairing of an individual's skills and abilities. Increasing range of motion so that an individual can perform meal preparation would involve establish/restore intervention strategies (Brown, 2009). Alter is defined as changing the actual environment in which a task is performed. One can alter the physical, temporal, social, or cultural elements. For example, a person with a substance abuse problem may alter their social context to be around individuals who support sobriety (Dunn, Brown, & Youngstrom, 2003). Adapt/modify is defined as changing the contextual features or task demands. An example of adapting is to incorporate assistive technology such as a power wheelchair to assist in community mobility. Prevent is defined as the development or maintenance of performance in any context to change the effects of a foreseen negative outcome. Using a specific cushion on an individual's wheelchair to prevent pressure ulcers is an example of a prevent intervention

(Brown, 2009). The final intervention strategy, create/promote is focused on creating circumstances that support optimal performance for all persons and populations. An example of create/promote is universal design in buildings and transportation, such as ramps and handicap bathrooms. These designs can increase performance for anyone regardless of their abilities (Dunn, Brown, & Youngstrom, 2003).

In order to best utilize these strategies an occupational therapist will need to find the best fit between the person variables and any contextual barriers the patient may face. Personal variables include, values, interests, and experiences, as well as, sensorimotor, cognitive, and psychosocial skills. Context barriers are challenges found within a specific context (physical, temporal, social, and cultural) that hinder occupational performance.

For example, a patient may value hunting but is no longer able to do so because their wheelchair will not allow them to go into the woods. An OT can utilize the EHP model to help. By identifying the value of hunting as a personal variable, and recognizing that there is a physical barrier they can utilize the adapt/modify intervention strategy to make adaptations to the wheelchair to allow for rough terrain mobility.

The EHP model views the patient encapsulated in their context with an infinite number of tasks available to them. The goal of the model is to increase the range of human performance so the person can engage in as many tasks as they desire in context. In the case of an individual with ALS, adaptation is often the only way in which they will be able to increase their performance range. This becomes truer as the disease progresses. In order to increase the performance range a therapist must understand what a person values (person), what they want to do (task), and where they want to perform the task (context). In the case of a patient with ALS, understanding these

concepts will help an OT select the assistive technology that best fits the person, task, and context.

Practical Implications of the Manual

There are resources available that aim to assist a caretaker or clinician in choosing various types of assistive technology that may be suitable for an individual with ALS. However, there are currently no manuals available that are geared towards assistive technology to increase independence in regard to community mobility, communication, and engagement in leisure activities throughout the progression of the ALS from an occupational therapy perspective.

ALS is a neuromuscular degenerative disease that progresses at such a rapid rate that continually choosing to meet the needs of an individual with the disease can be very difficult. Therapists and caregivers often don't know when to seek out credible AT resources, and patients often don't receive the devices they require to remain independent within the areas of communication, mobility, and leisure participation.

This manual will serve as a valuable resource for choosing assistive technology that is geared towards increasing independence in the areas of communication, mobility, and leisure participation throughout the progression of ALS. Occupational therapists and a variety of other associated healthcare practitioners will be able to utilize this manual as a single means of locating AT relative to these three areas of occupation, rather than having to locate and sift through a variety of other sources.

ALS is a disease that has seen a drastic increase in research popularity throughout the last couple decades. Promotional events such as the "ice bucket challenge" have increased awareness of the disease and raised a substantial amount of money to further research efforts. The body of knowledge related to ALS is continually growing as research related to the disease remains

pertinent, but there are still gaps in the research. There is little research related to patient satisfaction and reported usefulness with frequently prescribed assistive devices (Gruis, Wren, & Huggins, 2011). There is also a lack of research related to assistive devices that are geared towards increasing participation in leisure activities within the population of individuals diagnosed with ALS. Another area that requires further attention is early intervention efforts by the various therapeutic and health services. Often times occupational therapy services are not sought until after the disease has progressed to a point of severe impairment.

This manual is specifically geared towards individuals with ALS, however some of the information it contains may be useful for other diagnoses as well. Since ALS is considered a neuromuscular disease some of the information on various assistive devices in this manual may also apply to other diseases with similar prognoses. While symptomatology associated with ALS is typically more extreme and detrimental, there are a variety of other diseases that produce muscle weakness and/or speech issues. Multiple Sclerosis (MS), various spinal cord injuries (SCI), Primary Lateral Sclerosis (PLS), Progressive Bulbar Palsy (PBP), Spinal Muscular Atrophy (SMA), Primary Muscular Atrophy (PMA), Traumatic Brain Injury (TBI), Cerebral Vascular Accident (CVA), and other diseases with similar symptomatological aspects (Wijesekera & Leigh, 2009). These are just a few of the other diseases that may benefit some information associated with this manual.

The authors plan to upload this product online in the form of a PDF. This PDF will be available for all healthcare practitioners and other possible caregivers that have access to the internet and a compatible device. While the manual is intended to be used by practitioners and caregivers of individuals with ALS, it could also be utilized for a variety of other health related issues affecting speech and/or muscular function. The manual is primarily intended for use by

occupational therapy practitioners, but could potentially be utilized by other associated members of the healthcare team including physical therapists, speech therapists, recreational therapists, etc. The manual will be free of charge to access.

Conclusion

ALS is a degenerative neuromuscular disease that progressively degrades muscle integrity throughout the entire body. There is no known cure for this disease and the average lifespan once diagnosed is 3-5 years (Arbesman & Sheard, 2014). ALS limits several aspects of daily life including, communication, mobility and leisure participation. While there is no known cure for the disease the use of various forms of assistive devices has been shown to increase independence and overall quality of life for individuals with ALS. Assistive devices vary depending on the area of occupation they are geared towards and the level of assistance they are required to provide. The process of searching out assistive devices that are appropriate for an individual with ALS can be a tedious and stressful endeavor.

It is crucial that the assistive technology chosen for the individual are suited to their specific needs and endorsed by individuals with ALS who have used them in the past. The rapid progression associated with ALS means that an individual's assistive devices needs may change on a monthly basis. There is a need for a product that provides occupational therapists with a list of possible assistive devices that can address communication, mobility and leisure participation for individuals with ALS throughout the progression of the disease. This manual was created through use of the constructs of the EHP model and will provide occupational therapists with a list of possible assistive devices necessary to engage individuals with ALS in the occupations that they find most meaningful throughout the progression of the disease.

CHAPTER III

METHODOLOGY

An extensive literature review was conducted to gather information on Amyotrophic Lateral Sclerosis, assistive technology, assistive devices, augmentative alternative communication, computers, and leisure. Multiple search engines were utilized including, CINAHL, PubMed, Google Scholar, and Clinical Key. Articles were selected for further review that were relevant to the purpose and direction of this product. After both authors collected and wrote summaries on twenty articles, the literature review was written.

After a diagnosis of Amyotrophic Lateral Sclerosis (ALS), an individual and their family are often left with several questions. These questions may involve future mobility, communication, and leisure options. An occupational therapist can help answer the questions related to mobility, communication and other meaningful activities. Based on the current occupational therapy literature, speech and mobility issues are often present in individuals with ALS (Spataro, Ciriaco, Manno, & La Bella, 2013). Since there is no remedial action to reverse these effects of ALS, alternative augmented communication (AAC) and assistive technology (AT) is often required to carry out daily tasks. The purpose of this product is to give occupational therapy practitioners and other potential caregivers a manual that addresses the AT needs of individuals with ALS in order to optimize participation in functional mobility, communication, and leisure participation.

Based on the current literature the authors found a gap in the research relevant to the areas of communication, leisure, and mobility for individuals with ALS. The authors also found

that certain AT was recommended at specific points relevant to the progression of the disease. This led the authors to organize the product by stage of the disease, early stage, middle stage, and late stage. Within each stage, there are three distinct groups, (1) communication, (2) leisure, (3) mobility. In addition, ideas to improve mobility within the physical environment of the home were addressed through assistive technologies and home modifications.

This product uses the Ecology of Human Performance (EHP) model as a guide for each piece of assistive technology presented. The primary goal of the EHP model is to expand the tasks available to the person by changing their context to support performance. The EHP model considers a variety of contexts including; physical, social, cultural, and temporal. This model examines the psychosocial and sensorimotor aspects of a person, or person variables. Finally, the EHP model provides several intervention strategies to increase task participation.

The intervention strategies are aimed at person and context variables to increase task performance. *Establish/restore* primarily targets person variables and aims to remediate task performance or establish new skills/routines to accomplish a task. The intervention of *alter* is targeted at altering the context to enhance task performance. The intervention of *adapt/modify* is focused on changing the contextual features or task demands. The *prevent* intervention strategy targets the maintenance of performance in any context. Finally the *create/promote* strategy aims to promote adaptable performance of valued occupations in any context for any individual regardless of capabilities.

The product was constructed by using the stages of ALS as an organizational tool. For example, each section of the product follows a stage in the progression of ALS (early, middle, and late stage). The product begins with a short introduction and a list of key terms that will be used throughout the product. The authors included a short fact sheet that includes the

epidemiology, types, and diagnostic criteria for ALS. The authors also included a short list of assistive devices that everyone with ALS will need to improve quality of life and independent living. As stated above, the main sections of the product follow the stages of progression for ALS. Within each section the AT needs for communication, mobility, home modifications, and leisure are presented.

The authors chose the EHP model because the overall goal of the EHP model is to expand the performance range of tasks available to an individual within the context. The basic information for each device is provided as is the information related to the EHP model, stages of ALS, context, and intervention strategies.

The primary goal of occupational therapy when treating an individual with ALS is to maintain independence in activities of daily living, and functional mobility. Occupational therapists will play a large role in recommending communication and mobility modifications, as well as modifications to any activities that are meaningful to the patient such as leisure tasks.

CHAPTER IV

PRODUCT

This product was created to provide occupational therapists and caregivers with a resource for selecting appropriate assistive technology (AT) for individuals with Amyotrophic Lateral Sclerosis (ALS) as they progress through the disease. The AT provided in this manual is geared toward communication, mobility, home modifications, and leisure. Current research validates the use of AT to support functional independence for individuals with ALS in the areas of communication, mobility, and leisure (Fried-Oken et al., 2006). The purpose of this manual was to provide occupational therapists and caregivers with assistive technology that will increase the performance range of an individual with ALS within each stage of ALS.

The manual was structured to serve as a practical guide for occupational therapists and caregivers, it includes, a fact sheet for ALS, key terms used in the manual, a list of basic AT for ALS patients regardless of stage, as well as additional resources to research devices and resources for funding opportunities. The first section of this manual includes AT for an individual within the early stage of the disease progression. Each area (communication, mobility, home modifications, and leisure) within the section was organized and labeled clearly, a case study was also provided to help further understanding of how the device can be used to increase performance. The second and third sections of this manual included AT for an individual within the middle stage and late stage respectively, of the disease progression. Both of these sections are organized in the same manner as the first section.

For each device presented product information including, description, price, source, and features are provided. Following the product information, context variables and person variables related to the provided case study were analyzed. The information on how the device uses the intervention strategies of the EHP model was provided after the context variables and person variables. This chart provides information on how the device used the intervention strategies in a general sense and how it is used in relation to the case study.

An occupational therapist can use this manual to help select appropriate assistive technology for their patient with ALS. They could also show it to the patient and their family to allow them to have an understanding of what types of assistive technology may be needed in the future as the disease progresses. An OT or a caregiver could also use the resources provided at the end to conduct their own research for assistive technology that is pertinent to the patient's personal interests and values. This manual will assist an OT in extending the performance range of an individual in a variety of contexts as they progress through the ALS disease.

Assistive Technology to Enhance Occupations during Stages of ALS

A manual for occupational therapists and caregivers



Warren Ross, MOTS
&
Marcus Sickler, MOTS

TABLE OF CONTENTS

Key Terms	35
Fact Sheet	37
Basic AT needs for ALS	38
Section 1: Early Stage ALS	40
Case Study 1	41
Communication Assistive Technology	44
a) Whiteboard	
b) Magna Doodle	
Mobility Assistive Technology	57
a) Cane	
b) Forearm Crutch	
c) Walker	
d) Ergo Flight Ultra-light manual wheelchair	
Home Modifications	63
a) Adjustable Sink/Stove	
b) Pull Down Cabinets	
Leisure	71
a) Book holder	
b) Automatic card shuffler	

<u>Section 2: Middle Stage ALS</u>	79
<u>Case Study 2</u>	80
<u>Communication</u>	83
a) Letter board	
b) Picture board	
c) TrackerPro	
d) Sonivox Voice amplifier	
<u>Mobility</u>	94
a) Gait belt	
b) Maple transfer board	
c) E-motion M15 Power assist wheelchair	
d) Go-Go Elite Traveller plus Scooter	
<u>Home Modifications</u>	108
a) Offset Door Hinges	
b) Wheelchair Ramp	
c) EZ-Access transitions aluminum modular Threshold ramp	
d) Open Sesame automatic door opener	
e) AmeriGlide Rubex DC Stair lift	
f) Butler Mobility inclined platform wheelchair lift	

Leisure	127
a) Raised gardening beds	
b) TRACFAB All-Terrain tracked power wheelchair	
Section 3: Late Stage ALS	134
Case Study 3	135
Communication	138
a) iPad	
b) Proloquo2Go	
c) Tobii Dynavox I-Series	
Mobility	146
a) Hoyer Deluxe power lift	
b) Chrysler Accessible Van	
c) Quickie QM-710 power wheelchair	
Home Modification	153
a) Residential elevator	
Leisure	157
a) Tab Grabber tablet holder	
b) Tobii Dynavox Eyemobile Mini	
c) QuadStick game controller	
Additional AT Product Information and Funding Resources	167
References	169

Key Terms and Definitions:

ALS Types:

- ***Charcot's or spinal ALS*** is the most classic form of ALS and patients often initially present with focal muscle weakness beginning either proximally or distally (Wijesekera & Leigh, 2009).
- ***Flail arm or Vulpien-Bernhardt syndrome*** is a rare form of ALS that is characterized by progressive proximal weakness of the upper extremities, does not involve the lower extremities, bulbar, or respiratory muscles (Wijesekera & Leigh, 2009).
- ***Flail leg or Pseudo-polyneuritic syndrome*** is a rare form of ALS involving the lower motor neurons that is characterized by progressive proximal weakness of the lower extremities (Wijesekera & Leigh, 2009).
- ***Primary lateral sclerosis*** is a rare form of ALS that affects only the upper motor neurons and presents with weakness throughout voluntary muscles (Wijesekera & Leigh, 2009).
- ***Progressive bulbar palsy or Bulbar ALS*** is the second most common form of ALS and patients often initially present with speech dysarthria (Wijesekera & Leigh, 2009).
- ***Progressive muscular atrophy as known as Duchenne-Aran muscular atrophy*** is a subtype of motor neuron disease that affects only the lower motor neurons (Wijesekera & Leigh, 2009).

Ecology of Human Performance (EHP) Intervention Strategies:

- ***Establish/restore*** approach is designed to alter client characteristics in order to develop an ability that has yet to be developed or restore an ability that has been impeded (Dunn, Brown, & McGuigan, 1994)
- ***Create/promote*** approach is established to provide enhanced contextual and task experiences that will ultimately increase performance for any individuals in the organic life context (American Occupational Therapy Association, 2014).
- ***Modify*** approach is designed to develop ways to revamp the current context or task demands to enhance performance in the individual's natural setting (Dunn et. al, 1994).
- ***Prevent*** approach is designed to adhere to the needs of individuals who may or may not have any disability, but are at risk for performance capacity issues (Dunn et. al, 1994).

Context:

- **Cultural context** refers to beliefs, customs, patterns of activity, standards of behavior, and societal expectations within which an individual identifies (AOTA, 2014).
- **Physical context:** Refers to geographic terrain, plants, and animals, as well as sensory qualities of the surroundings, it also refers to buildings, furniture, tools and devices (AOTA, 2014).
- **Social context:** Refers to the presence of, relationships with, and expectations of person, groups, and populations with whom the clients have contact (AOTA, 2014, p.S45).
- **Temporal context** refers to the time of day, time of year, stage of life, health status, history, and tempo or duration of task (AOTA, 2014), (Dunn, Brown, & Youngstrom, 2003).

Assistive Technology:

- **Assistive Technology:** equipment, services, and approaches to alleviate the issues dealt with by individuals who have disabilities (Cook & Polgar, 2015).

ALS Statistics and Facts:

- Amyotrophic lateral Sclerosis (ALS) is a degenerative neuromuscular disease that progressively degrades muscle integrity throughout the entire body (Schettini et al., 2015).
- Amyotrophic lateral sclerosis (ALS) impacts approximately 20,000 individuals in the United States every year (Fried-Oken et al., 2006).
- The median survival rate after diagnosis is approximately 3 years with the most common causes of death stemming from pneumonia, pulmonary failure, or cardiac arrhythmias (Arbesman & Sheard, 2014).
- The lifetime incidence risk for developing ALS is approximately 1 per 400 for females and 1 per 350 for men, or 3 per 100,000 per year for men and 2 per 100,000 per year for woman (Kiernan et al., 2011).
- The incidence rate of ALS is currently recorded at approximately 2 people per 100,000 per year or about 5 people per 100,000 on a population basis (Wijesekera & Leigh, 2009).
- ALS is the most frequently diagnosed motor neuron disease within the United States (Arbesman & Sheard, 2014).
- The average age of onset for ALS is between 49-60 years of age (Kiernan et al., 2011).
- The most recent research specifies that symptomology progression in ALS is not linear, rather curvilinear, with the swiftest rate of deterioration occurring during the early and later stages of the disease (Arbesman & Sheard, 2014).

Sources:

Arbesman, M., & Sheard, K. (2014). Systematic review of the effectiveness of occupational therapy-related interventions for people with amyotrophic lateral sclerosis. *American Journal of Occupational Therapy*, 68, 20–26. <http://dx.doi.org/10.5014/ajot.2014.008649>

Fried-Oken, M., Fox, L., Marie, R., Tullman, J., Baker, G., Mary, H., Wile, N., Lou, J. (2006). Purposes of AAC device use for persons with ALS as reported by caregivers. *Augmentative and Alternative Communication*, 22 (3), 209-221. doi: 10.1080/07434610600650276

Kiernan, M., Vucic, S., Cheah, B., Turner, M., Eisen, A., Hardiman, O., Burrell, J., Zoing, M. (2011). Amyotrophic lateral sclerosis. *Lancet*, 377, 942-955. doi:10.1016/S0140-6736(10)61156-7

Schettini, F., Riccio, A., Simione, L., Liberati, G., Caruso, M., Frasca, V., ... Cincotti, F. (2015). Assistive device with conventional, alternative, and brain-computer interface inputs to enhance interaction with the environment for people with amyotrophic lateral sclerosis: a feasibility and usability study. *Archives of Physical Medicine and Rehabilitation*, 96, 46-53. Doi.org /10.1016/j.apmr.2014.05.027

Wijesekera, L. C., & Leigh, P. N. (2009). Amyotrophic lateral sclerosis. *Orphanet Journal of Rare Diseases*, 4, 3. <http://doi.org/10.1186/1750-1172-4-3>

Basic AT

Button Hook



www.amazon.com/Button-Hook-Vive-Dexterity-Guarantee/dp/B00WRG9LRI

Description: Assists in one handed buttoning and unbuttoning of shirts. Loop fits over the button for easy use.

Price: \$10.99

Source: Amazon, Target, Walmart

Dressing Stick



www.amazon.com/Kinsman-Dressing-Stick-33500/dp/B000HZXOP6

Description: Long handled stick to assist in dressing. Can help put on or take off a coat, shirt, socks, and shoes.

Price: \$5.21

Source: Amazon, Target, Walmart

Reacher



www.amazon.com/Essential-Medical-Supply-Reacher-32/dp/B001CBA286

Description: Extends functional reach and alleviates the need for bending or unsafe leaning.

Price: \$13.90

Source: Amazon, Target, Walgreens

Sock Aid



www.amazon.com/Eva-Medical-Sock-Foam-Grip/dp/B010WC82MI

Description: Helps pull on socks or stockings, can be used one handed. Alleviates the need for bending.

Price: \$8.70

Source: Amazon, Target, Walgreens

Universal Cuff



www.amazon.com/North-Coast-Medical-Norco-Universal/dp/B0052ZW5TM

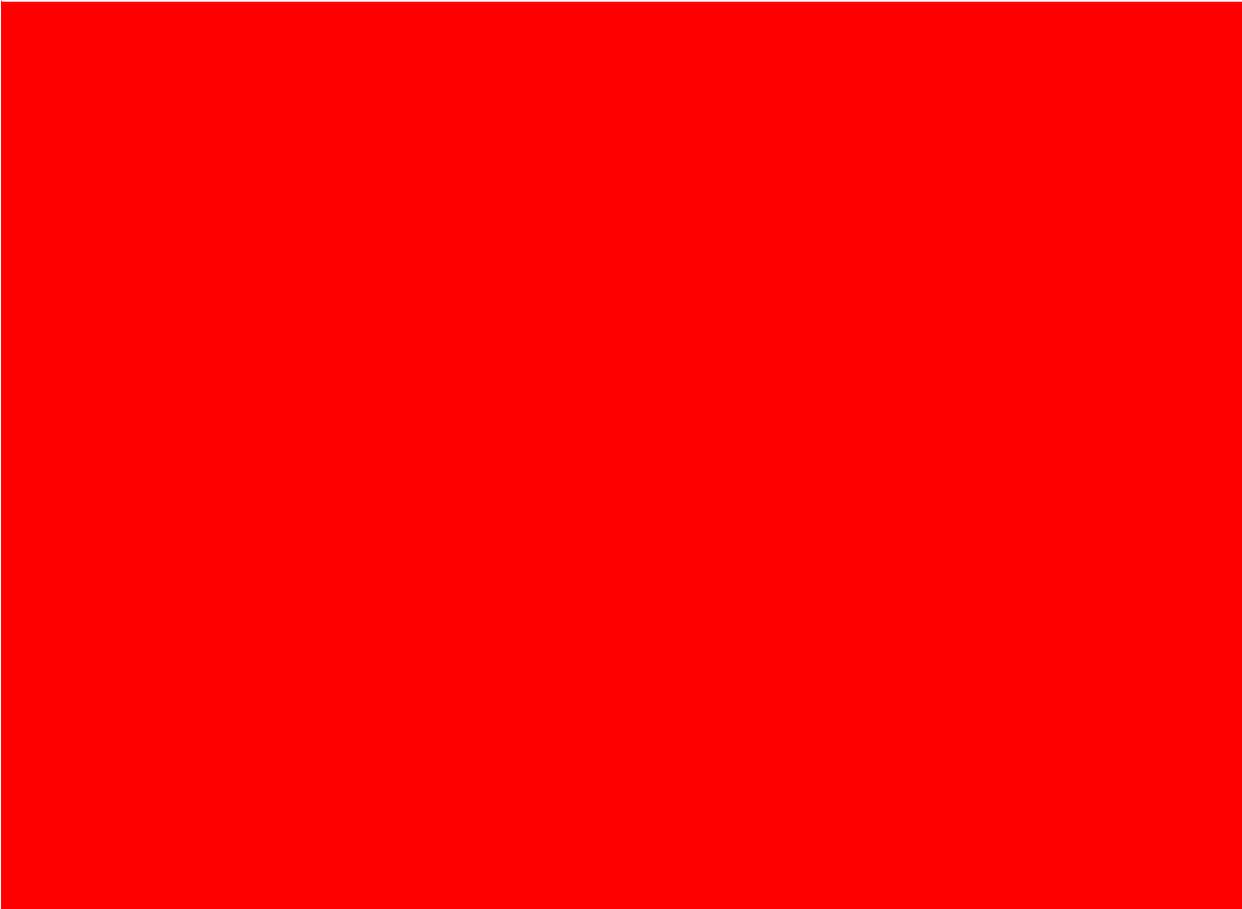
Description: Helps an individual that can no longer grasp maintain independence in feeding tasks. Adjustable up to an 8-inch circumferential palm.

Price: \$9.87

Source: Amazon, Target, Walmart



SECTION 1
EARLY STAGE ALS



Case Study 1

Avogadro is a 51-year-old male from Aurora, Colorado and has worked as an accountant for a Fortune 500 Company for 25 years. He lives in a three-story home with his wife, Maria, the family dog, and their three children aged, 16, 14, and 12. Maria has enjoyed her work as the district attorney for Denver over the last 25 years. Avogadro has several interests, his outdoor interests include, hunting, hiking, snowboarding/skiing, and gardening with his family. His indoor interests include, cooking, reading, playing cards and video games with his children, listening to music and watching videos on YouTube. Due to the work that Avogadro and Maria have done over the last 25 years they have become financially stable.

Three weeks ago, Avogadro started to experience muscle weakness in both of his legs. He later discovered that he was not able to stand up for long periods of time and decided to go and see his doctor. After a visit with his doctor, he was diagnosed with Charcot's (spinal) Amyotrophic Lateral Sclerosis (ALS). He learned that Charcot's (spinal) ALS is the most common type of ALS and that it typically affects the muscles in the upper and lower body. The doctor informed him that there is no cure or for his condition and, that the treatment would be focused on making adaptations and modifications to his environment to increase his ability to perform meaningful activities. The doctor referred him to an occupational therapist to discuss assistive technology options that he may find useful in completing his daily tasks and meaningful occupations.

Avogadro scheduled an appointment with an occupational therapist (OT) that would take place in two weeks' time. When he arrived at the appointment, he shared with the OT that he was experiencing fatigue when speaking with his wife and children. He also shared that he was having a hard time standing up and when he did stand up he had trouble with his balance, sharing that he has fallen twice since his diagnosis. In addition, he also stated that he was having trouble with some of his identified leisure activities.

Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values family game night and American family tradition.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the early stage of ALS

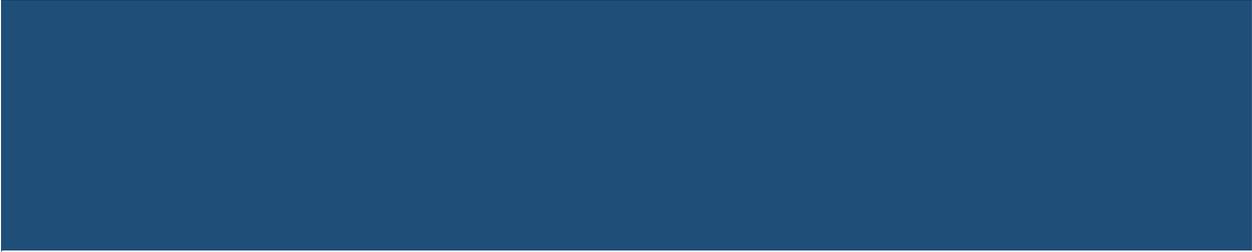
Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in legs Fatigue when standing-poor balance Fatigue when talking
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his friends and co-workers/clients. • Patient is interested in maintaining safety within the home and maintaining mobility within the community with his family. • Patient is interested in continuing game night with family and solitary activities. • Patient is interested in continuing to cook and clean for his family.

Assistive Technology Recommendations

The communication devices were recommended because they will reduce Avogadro's fatigue when communicating.

- The devices for mobility were selected because they will encourage safety when walking inside and outside the home.
- The home modifications were selected because it will allow Avogadro to maintain engagement in the cooking and cleaning activities that he finds meaningful.
- The devices for leisure were selected because they allow Avogadro to engage in the family and personal leisure activities he finds most meaningful.



**SECTION 1
COMMUNICATION
ASSISTIVE TECHNOLOGY**



Erasable Personal White Board



www.usmarkerboard.com/ctgry/Whiteboards-Markerboards/3?gclid=CjwKEAjjw19vABRCY2YmkpO2OzTsSJAAsEt8sUZUor2VRvlOa1FTZRxlVBSyJxoaExuh77hd6D19M-BoCeR_w_wcB

Description	Lap style dry erase white board. Can help individuals who have difficulty with speech production, but have maintained functional hand use.
Price	\$10.00 - \$25.00+ shipping and handling if purchased online
Source	www.usmarkerboard.com Also available at most general stores such as Walmart and Target
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Easy to use - Inexpensive - The individual is able to customize the message they would like to communicate with others.
Cons	<ul style="list-style-type: none"> - May be fatiguing to the individuals hands. - May require an extended amount of time to communicate with others - May be difficult to portray emotions when utilizing a white board. - If the marker runs out the individual is unable to communicate until another marker is retrieved.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>Once an individual with ALS begins to experiences difficulties with speech, this device can be utilized as a means of restoring communication as to allow them to express thoughts and feelings with others.</p>
	<p align="center">Case Study Application</p> <p>Avogadro is experiencing difficulty with speech production, so this device can be utilized to restore his ability to communicate with his family, friends, and co-workers.</p>
Alter	<p align="center">General Application</p> <p>This device can be utilized in a variety of settings (individuals home, public settings) due to its portability and convenience.</p>
	<p align="center">Case Study Application</p> <p>This intervention strategy will not be used with Avogadro since he will only use this device when at home.</p>
Adapt/Modify	<p align="center">General Application</p> <p>If the individual begins to lose function within their fingers, this device can be modified by applying a universal cuff to the marker that goes along with it. The device can also be strapped down to their wheelchair or another surface for support as well.</p>
	<p align="center">Case Study Application</p> <p>As the strength within Avogadro's hands continue to diminish, he can be fitted with a universal cuff which will modify the white board to enable him to continue to use it.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent social isolation, boredom, and depression by providing the individual with a means of communicating with others. By using this device, the individual is able to express himself or herself in a modified fashion.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro is beginning to experience difficulty with communicating with his family, friends, and co-workers, so this device can be utilized to prevent social isolation and depression by providing him with a means communicating with these individuals.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>Any individual regardless of ability can use this device to communicate with others. The most likely application would be leaving notes in an area where others will easily see it, i.e. kitchen fridge.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro will use this device to promote communication with his family when he is at home.</p>

Magna Doodle



www.target.com/p/etch-a-sketch-travel-doodle/-/A-15038538

Description	Lightweight, portable, lap style communication drawing board. This device can help individuals who have difficulties with speech production, but have maintained functional hand use.
Price	\$19.99 – \$29.99+ shipping and handling if purchased online
Source	www.target.com Also available at general stores such as Target and Walmart
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Easy to use - Cheap - The user is able to customize the message they would like to communicate with others.
Cons	<ul style="list-style-type: none"> - May become fatiguing to the users hands - May take an extended amount of time to communicate with others. - May be difficult to express emotion when communicating with others.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>Once an individual with ALS begins to experiences difficulties with speech, this device can be utilized as a means of restoring communication as to allow them to express thoughts and feelings with others even when they lack the endurance to hold various conversations throughout the day.</p>
	<p align="center">Case Study Application</p> <p>This device may be utilized to restore Avogadro's ability to communicate effectively with his friends and family without experiencing fatigue within his speech production musculature.</p>
Alter	<p align="center">General Application</p> <p>This device can be utilized in a variety of settings (individuals home, public settings) due to its portability and convenience.</p>
	<p align="center">Case Study Application</p> <p>This intervention strategy will not be used with Avogadro since he will only use this device when at home.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>If the individual begins to lose function in their fingers, a universal cuff may be utilized to ensure that they are still able to use this device if they wish to continue. The device can also be strapped down to their wheelchair or another surface for support as well. There are smaller and larger variations of this device that can be utilized to meet the skills of the user.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device could be modified to meet Avogadro's needs by providing him with universal cuff and a wheelchair mount to increase his competency with the device.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent social isolation, boredom, and depression by providing the individual with a means of communicating with others non-verbally.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device can be utilized with Avogadro to prevent social isolation and a feeling of separation from his family by allowing them to communicate more effectively.</p>



**SECTION 1
MOBILITY
ASSISTIVE TECHNOLOGY**



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values family game night and American family tradition.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter
Temporal	Middle aged man in the early stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in legs Fatigue when standing-poor balance Fatigue when talking
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his friends, and co-workers/clients. • Patient is interested in maintaining safety within the home and maintaining mobility within the community with his family. • Patient is interested in continuing to cook and clean for his family. • Patient is interested in continuing game night with family and solitary activities.

Assistive Technology Recommendations

The devices of mobility were selected because they will encourage safety when walking inside and outside the home. **Note:** Insurance companies will only cover **one type** of mobility equipment at a time.

Cane



www.1800wheelchair.com/product/sky-med-stand-alone-cane/ traveltips.usatoday.com/proper-height-walking-cane-63172.html

Description	Lightweight standing cane. Can help individual with unsteady balance.
Price	\$27+ shipping and handling
Source	www.1800wheelchair.com/product/sky-med-stand-alone-cane/ Any medical equipment supply store
Features/Pros	<ul style="list-style-type: none"> -Adjustable height 30"-39" -Available in a variety of colors -Stands on its own-does not fall over -Lightweight -Low cost -Max weight of use 250 lbs.
Cons	-Cane does not collapse for easy transport

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device restores an individual's ability to mobilize around their home and community with enhanced stability.</p>
	<p align="center">Case Study Application</p> <p>This device restores Avogadro's ability to safely mobilize around his home and in his community, increasing stability and reducing the risk of falls.</p>
Alter	<p align="center">General Application</p> <p>An individual can use this device in a variety of contexts.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device at home and at work to improve stability and reduce his risk of falling due to his leg weakness.</p>
Adapt/Modify	<p align="center">General Application</p> <p>An individual can use this device to modify their method of mobility by providing support to help with standing and walking balance.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device to modify his mobility inside and outside of his home.</p>
Prevent	<p align="center">General Application</p> <p>This device prevents the risk of falls for an individual with ALS.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device to prevent falls at home, work, and in the community.</p>

Forearm Crutch



justwalkers.com/adult-bariatric-steel-forearm-crutches.html www.wikihow.com/Hold-and-Use-a-Cane-Correctly

Description	Lightweight forearm crutches. Can help individuals who have upper body control and weak legs or unsteady balance.
Price	\$79.00+ shipping and handling
Source	justwalkers.com/adult-bariatric-steel-forearm-crutches.html Any medical equipment supply store
Features/Pros	<ul style="list-style-type: none"> -Adjustable height-28"-37" -Max weight of use-500 lbs. -Leg and forearm adjustments are independent of each other. -Ergonomically contoured arm cuffs -Sold as a pair -Lifetime Warranty
Cons	<ul style="list-style-type: none"> -Do not collapse for easy transport -Need to use both crutches –makes transportation more challenging. -Heavy-5.7 lbs. for the pair. -Training needed for proper use

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device restores an individual’s ability to mobilize around their home and community with enhanced stability.</p>
	<p align="center">Case Study Application</p> <p>This device restores Avogadro’s ability to safely mobilize around his home and in his community, increasing stability and reducing the risk of falls.</p>
Alter	<p align="center">General Application</p> <p>An individual can use this device in a variety of contexts.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device at home and at work to improve stability and reduce his risk of falling due to his leg weakness.</p>
Adapt/Modify	<p align="center">General Application</p> <p>An individual can use this device to modify their method of mobility.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device to modify his mobility inside and outside of his home.</p>
Prevent	<p align="center">General Application</p> <p>This device prevents the risk of falls for an individual with ALS.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device to prevent falls at home, work, and in the community.</p>

Walker



www.1800wheelchair.com/category/294/adult-walkers/

Description	Relatively lightweight, portable (foldable), mobility walker. This is a more basic mobility device when compared to other options such as a wheelchair. It works great for individual that have compromised leg function, but that have maintained some upper extremity functionality and postural strength. Comes in different styles depending on the needs of the user.
Price	\$38.00-\$265.00+ shipping and handling
Source	www.1800wheelchair.com/category/294/adult-walkers/ Also available at most medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable (foldable) - Affordable for mobility relative to mobility devices - Multiple options to suit the needs of the user.
Cons	<ul style="list-style-type: none"> - May be fatiguing to the individual's upper extremities. - Can be slightly cumbersome in small or confined areas.

EHP Intervention Strategies

Establish/Restore

General Application

If an individual with ALS is reporting weakness within their lower limbs and a lack of balance, this device can be utilized to restore their ability to safely remain mobile.

Case Study Application

Avogadro reports that he is unable to stand for an extended period of time and that he has poor balance when he is standing. This device can be utilized to restore Avogadro's ability to remain mobile and safely balance while he is standing.

Alter

General Application

If the individual's home setting is not accommodating to a walker the individual could alter their physical environment by moving to a new place of residence that is easier to move around in with a walker.

Case Study Application

This intervention strategy is not applicable for Avogadro because he wishes to remain in his home environment.

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>This device can be modified to best meet the needs of the user by increasing or decreasing the height of the legs, adding tennis balls to the legs for extra friction, or swapping out the handles for a more ergonomic and comfortable solution.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device could be modified to meet Avogadro's needs by increasing or decreasing the height of the legs to match his height. It could also be modified to have more comfortable handles and possible tennis balls at the bottom of the legs to decrease friction and increase control. Depending on the type of walker, Avogadro may be able to place items on the seat; this will allow him to carry objects from one area to another.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized with an individual with ALS to prevent lack of mobility, social isolation, and falls.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro reports that he is experiencing difficulty with standing for long periods of time and balancing while he is standing. This device can be utilized with Avogadro to prevent lack of mobility, social isolation, and potential for falls.</p>

Ultra-light Manual Wheelchair



www.spinlife.com/category.cfm?categoryID=38&adv=googleads&tar=ultralight%20wheelchair-b&utm_source=google&utm_medium=cpc&utm_content=18720570444&utm_campaign=Wheelchairs-Ultralight

Description	Relatively lightweight, portable (foldable), mobility wheelchair. This piece of equipment is the first and most basic option for a mobility device regarding wheelchairs. It works great for an individual that have compromised leg function, but that have maintained some upper extremity functionality.
Price	\$689.00-\$2,465.00+ shipping and handling if ordered online
Source	www.spinlife.com Also available at most medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Relatively light weight - Portable (foldable) - Modifiable - Affordable relative to wheelchair options. - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - May be fatiguing to the individual's upper extremities. - May require modifications to the individual's environment in order to properly use this piece of equipment. - May require maintenance.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>If an individual with ALS lacks adequate lower extremity strength for walking, but have maintained their upper extremity strength, they can utilize this device to restore their ability to remain mobile within their home, work, and community settings.</p>
	<p align="center">Case Study Application</p> <p>Avogadro is beginning to experience weakness within his lower extremities and mobility is becoming an issue for him. This device can be utilized to restore his ability to get around within his home, work, and community settings.</p>
Alter	<p align="center">General Application</p> <p>This device can be utilized in a variety of settings (individuals home, public settings) due to its portability and convenience.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device in his home, community, and work environments.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>The ultra-light manual wheelchair can be modified to best meet the needs of the user by adapting the seat cushion, adapting the leg rests, adapting the armrests, and building up the brake handles to make stopping easier.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro's wheelchair can be modified to best meet his needs and increase his level of comfort by building up his seat cushion, installing more comfortable arm and leg rests, and building up the brake handle to make stopping easier.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>All individuals dealing with ALS will eventually lose their ability to weight bear on their legs, so this device can be utilized to prevent lack of ability to remain mobile, as well as social isolation and depression.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro is beginning to lose the strength and endurance within his leg muscles, which will make getting around difficult. This device can be utilized to prevent lack of ability to remain mobile within his home, work, and community settings, and social isolation and possibly depression with Avogadro.</p>



SECTION 1

HOME MODIFICATION



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values family game night and American family tradition.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter
Temporal	Middle aged man in the early stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in legs Fatigue when standing-poor balance Fatigue when talking
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers. • Patient is interested in maintaining safety within the home and maintaining mobility within the community with his family. • Patient is interested in continuing to cook and clean for his family. • Patient is interested in continuing game night with family and solitary activities.

Assistive Technology Recommendations

The home modifications were selected because it will allow Avogadro to maintain engagement in the cooking and cleaning activities that he finds meaningful.

Adjustable Sink/Stove



freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTSINK
freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTCOOKTP .

Description	Adjustable kitchen sink and stove that allows for someone in a seated position to engage in tasks at a stove or sink.
Price	Sink: \$2,085 Stove:\$2,085 Total: \$4,170
Source	freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTSINK freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTCOOKTP
Features/Pros	-Adjustable range from 28”-36” -Holds 250lbs. -Safety shutoff stops travel if barrier is detected -Counter width 36”-48”
Cons	-Cost -Sink requires a drain approach kit that is not included

EHP Intervention Strategies	
Establish/Restore	General Application These devices can be used to restore participation in activities of daily living such as meal preparation, cleaning, and self-care when in a seated position.
	Case Study Application Avogadro can use these devices to restore his ability to engage in meal preparation, cleaning, and self-care while in a seated position. Avogadro can use the adjustable sink to do the dishes for his family and could use it for brushing his teeth, combing his hair etc. if his bathroom sink does not allow access for his wheelchair.
Alter	General Application A patient with ALS could learn how to operate them and how to best use them in an occupational therapy clinic.
	Case Study Application Avogadro could use the adjustable surface at an OT clinic or medical supply store to ensure that he will be able to use it effectively prior to purchasing the device.
Adapt/Modify	General Application This device can be adjusted to a variety of heights. Therefore, it is highly compatible with a wheelchair user.
	Case Study Application By bringing the cooking or cleaning surface down to a level that is more acceptable for Avogadro when he is in a wheel chair, Avogadro will be able to continue in his role of cooking and cleaning for his family.

Prevent	<p style="text-align: center;">General Application</p> <p>These devices can be used to prevent loss of independence in meal preparation, cleaning and self-care tasks.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use these devices to prevent a loss of independence and occupational identity in meal preparation and cleaning for his family. He can also use them to prevent loss of independence in self-care tasks such as, brushing his teeth, combing his hair etc.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device can be used by anyone regardless of disability to compensate for the varying height of individuals.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use these devices to promote independent living since it will allow him to perform cooking, cleaning and self-care activities from a seated position. It will also promote a sense of occupational identity since Avogadro will be able to cook and clean for his family. Installing these devices will also create cooking opportunities for Avogadro.</p>

Pull Down Cabinets

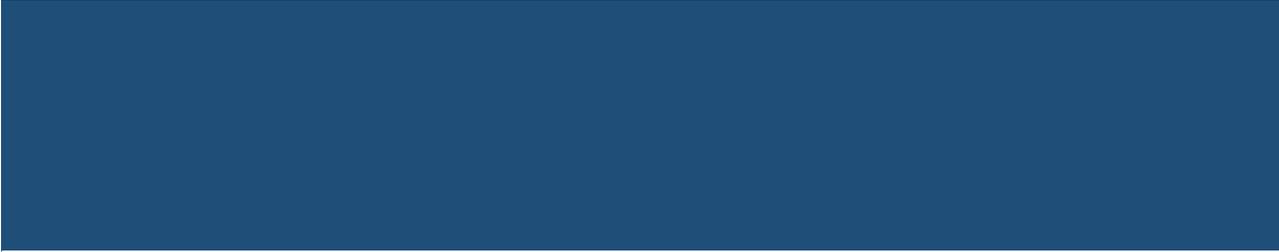


freedomliftsystems.com/Wheelchair-Accessible-Kitchen/830-VERTI-15-39INCH

Description	A cabinet accessory that raises and lowers cupboard shelves smoothly and quietly so that the contents may be accessed from a seated position.
Price	\$2,254 per cupboard
Source	freedomliftsystems.com/Wheelchair-Accessible-Kitchen/830-VERTI-15-39INCH
Features/Pros	<ul style="list-style-type: none"> -Allows for seated access to cupboard contents -Motor driven -Smooth movement -88 lbs. weight capacity -Fits inside existing kitchen cabinets
Cons	<ul style="list-style-type: none"> -Cost -Need to buy one for each cupboard -May still be too high for an individual to reach

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to establish participation in activities of daily living and maintaining independence in meal preparation and organization.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device to increase his ability to cook and organize kitchen items by allowing him access to supplies he needs for meal preparation tasks.</p>
Alter	<p align="center">General Application</p> <p>A patient with ALS could learn how to operate them and how to best use them in an occupational therapy clinic.</p>
	<p align="center">Case Study Application</p> <p>Avogadro could use the adjustable surface at an OT clinic or medical supply store to ensure that he will be able to use it effectively prior to purchasing the device.</p>
Adapt/Modify	<p align="center">General Application</p> <p>This device brings the contents of the kitchen cabinets down to a level that is appropriate for a person in a wheelchair. Therefore, allowing the patient to access items for meal preparation and cleaning in order to maintain independence.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will modify the method of accessing kitchen items such as bowls, plates, cups, etc. Avogadro will be able to access these items from seated position without risking injury from falling objects.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device will prevent loss of independence in meal preparation and organization.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to prevent the loss of independence in meal preparation and organization. Avogadro will be able to access kitchen items and will be able to place items back in his cabinets independently with a decreased risk of injury.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device can be used by anyone regardless of disability to compensate for the varying height of individuals</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to promote independent living since it will allow him to perform cooking and organizational activities from a seated position. He will be able to independently obtain kitchen items for meal preparation and will be able to independently place kitchen items back once he is done using them. This device will also create easier access to the cupboards for his family members.</p>



**SECTION 1
LEISURE
ASSISTIVE TECHNOLOGY**



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values family game night and American family tradition.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter
Temporal	Middle aged man in the early stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in legs Fatigue when standing-poor balance Fatigue when talking
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers. • Patient is interested in maintaining safety within the home and maintaining mobility within the community with his family. • Patient is interested in continuing to cook and clean for his family. • Patient is interested in continuing game night with family and solitary activities.

Assistive Technology Recommendations

Assistive technology for leisure was selected because they allow Avogadro to engage in the family and personal leisure activities he finds most meaningful.

Book Holder



www.amazon.com/Actto-BST-09-adjustable-Portable-Document/dp/B005IV6U0U/ref=zg_bs_490620011_1
www.pinterest.com/pin/130956301636151948/

Description	Low cost option to hold books for an individual with ALS. This device will help an individual with energy conservation.
Price	\$11.88+ shipping and handling
Source	www.amazon.com/Actto-BST-09-adjustable-Portable-Document/dp/B005IV6U0U/ref=zg_bs_490620011_1 Barnes and Noble Target Walmart
Features/Pros	-Lightweight -Dimensions 10.5 x 3 x 7.9 inches -Holds larger books and magazines.
Cons	-Requires a tray to carry it anywhere -Does not attach to the wheelchair -Page holders may get in the way of reading

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to restore an individuals' ability to engage in reading activities by holding the text for them therefore decreasing fatigue.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will be able to use this device to restore his ability to engage in reading activities. The device will hold the book for Avogadro, which will decrease his fatigue during the activity.</p>
Alter	<p align="center">General Application</p> <p>A person could use this device in various settings.</p>
	<p align="center">Case Study Application</p> <p>Alter would not be used in Avogadro's case since he only reads for leisure at home.</p>
Adapt/Modify	<p align="center">General Application</p> <p>This device will modify the task of reading by holding the text for the patient.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will modify his method of reading by placing the text in the book holder. This will reduce the level of fatigue for Avogadro by reducing his need to hold the text.</p>

Prevent	<p align="center">General Application</p> <p>This device will prevent occupational deprivation, and boredom in an individual with ALS.</p>
	<p align="center">Case Study Application</p> <p>This device will prevent Avogadro from being deprived of his leisure activity of reading and will prevent him from becoming bored by allowing him to engage in reading.</p>
Create/Promote	<p align="center">General Application</p> <p>An individual could use this device regardless of ability to hold text while engaging in another task such as cooking.</p>
	<p align="center">Case Study Application</p> <p>This device will promote occupational engagement for Avogadro, allowing him to participate in his meaningful occupation of reading, increasing his quality of life. He will also be able to read educational materials for work.</p>

Automatic Card Shuffler



www.adaptivetechsolutions.com/card-shuffler-switch-adapted/

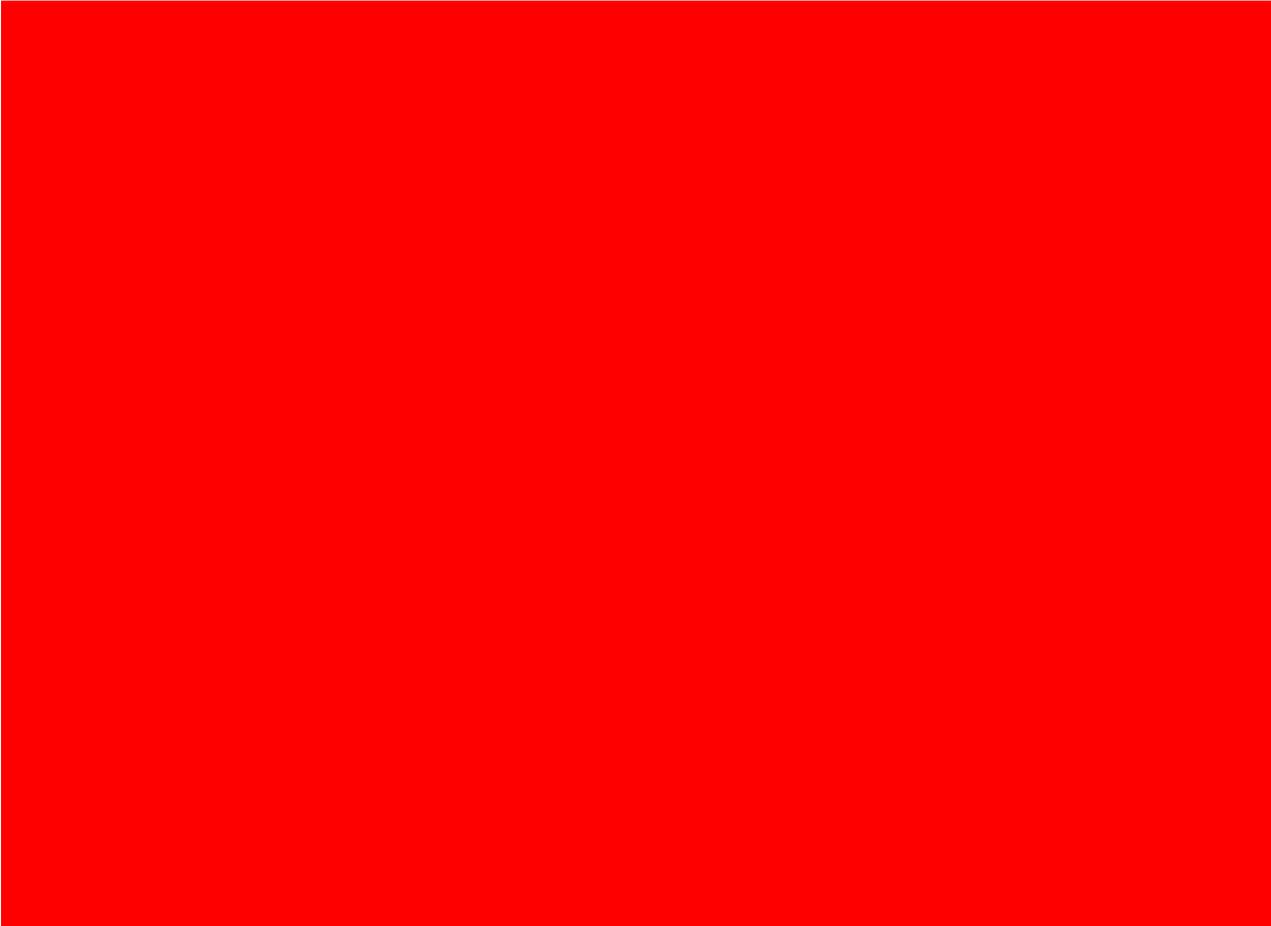
Description	Automatic card shuffler allows a user to place up to two decks of cards and shuffle them with minimal effort. Ideal for individuals that have trouble shuffling cards due to pain, arthritis, or decreased dexterity.
Price	\$7.99-28.95
Source	Target, Walmart, Kohl's, Adaptive Tech Solutions.
Features/Pros	<ul style="list-style-type: none"> -Can shuffle up to two decks at a time. -Easy to use, can be operated by push button or a standard switch -Momentary switch--on when you press switch off when you release -Battery operated
Cons	<ul style="list-style-type: none"> -Switch sold separately -Switch is expensive-\$56 +

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device will restore an individual's ability to play cards without fatiguing due to shuffling.</p>
	<p align="center">Case Study Application</p> <p>This device will restore Avogadro's ability to engage in game night with his family.</p>
Alter	<p align="center">General Application</p> <p>A person could use this device in various contexts and within several social groups.</p>
	<p align="center">Case Study Application</p> <p>Alter would not be used in Avogadro's case since he will only be playing card based games with his family in his home.</p>
Adapt/Modify	<p align="center">General Application</p> <p>This device will modify the method through which an individual will shuffle cards, reducing fatigue during the activity.</p>
	<p align="center">Case Study Application</p> <p>This device will modify how Avogadro plays cards and games that use cards with his family. The device will reduce fatigue for Avogadro when performing this task.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device will prevent occupational deprivation and boredom in an individual with ALS.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device will prevent Avogadro from being deprived of his leisure activity of playing cards with his family, and will prevent him from becoming bored by allowing him to engage in game play.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>An individual could use this device regardless of ability to shuffle cards evenly and consistently for game play.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device will promote occupational engagement for Avogadro, allowing him to participate in his meaningful occupation of playing cards, increasing his quality of life.</p>



SECTION 2
MIDDLE STAGE ALS



Case Study 2

Eight months after his initial visit with his OT, Avogadro scheduled a follow up appointment because he noticed his condition was worsening. When talking with his OT, Avogadro stated that he was experiencing decreased endurance within his arms and hands. His family stated that he was not able to stand up on his own even with the aid of a cane or walker, which impairs his ability to get into the house. The OT noticed that Avogadro was hard to hear due to the volume of his voice and Maria reported that at times, he was unable to be heard over the noise of the kids. Avogadro also reported that he was experiencing difficulty completing all necessary tasks at work because he was having a hard time writing down information and inputting information into his computer. Avogadro and his wife expressed concerns with the level of support he requires when completing tasks at home such as, climbing stairs, opening doors, and gaining entrance into the house. Maria stated that there are four steps to gain access into the home. Maria also stated that Avogadro has been sleeping in his recliner in the living room at night because he is unable to access his bedroom on the second floor. Avogadro expressed concern that he would not be able to hunt with his children this year due to not being able to walk around the woods.

Context Variables

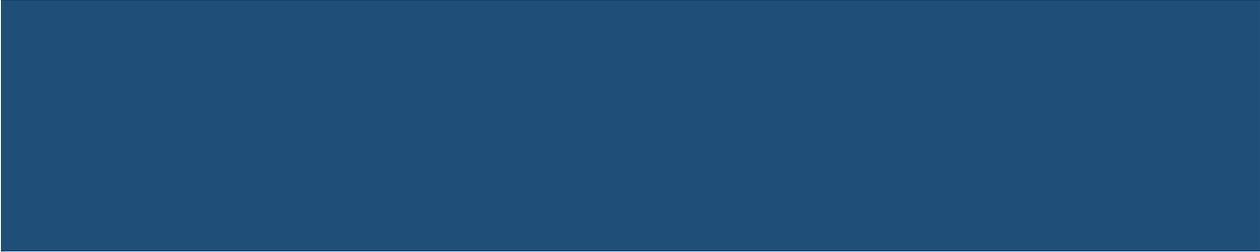
Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values outdoor activities, family bonding time, and maintaining a sense of identity.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the middle stage of ALS

Person Variables

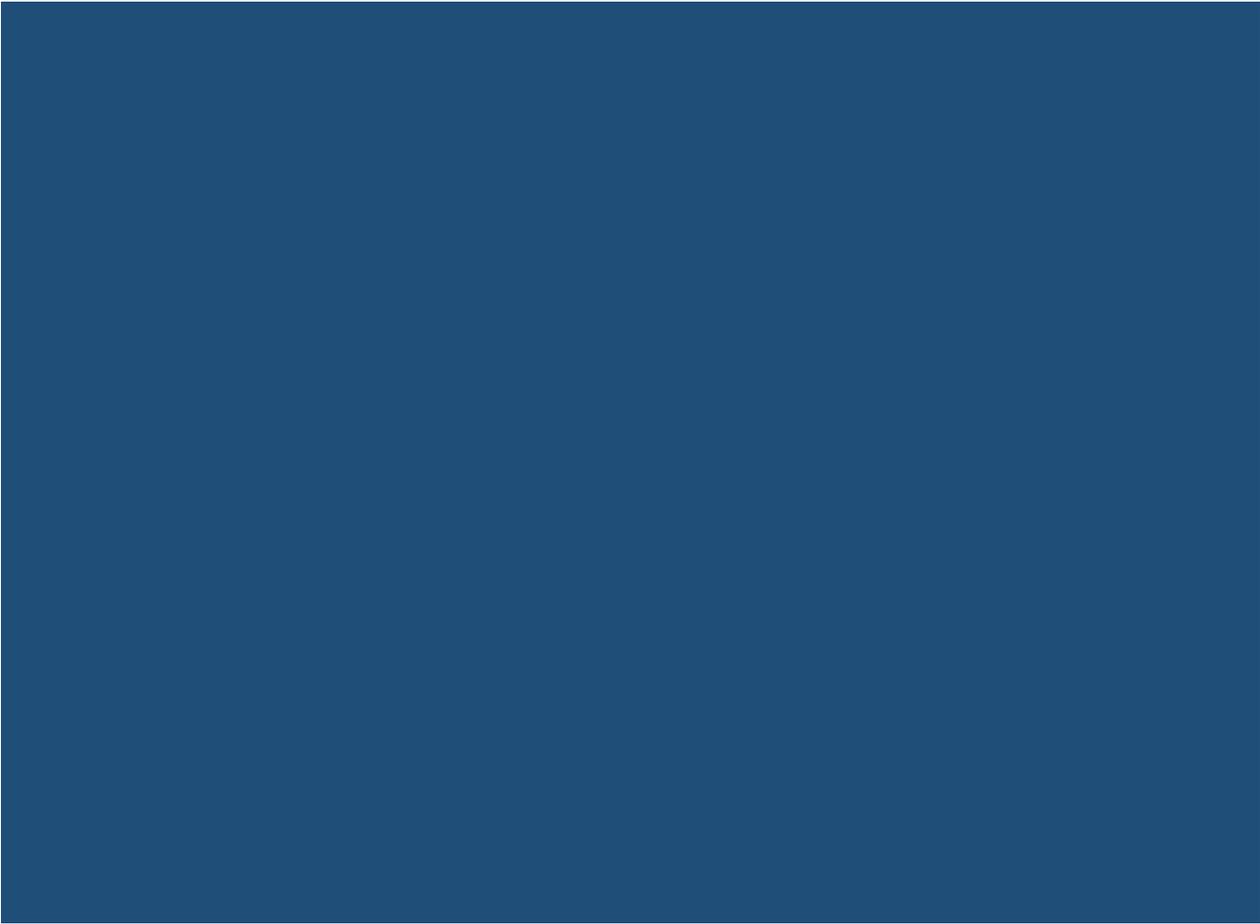
Variables	Challenges
Sensorimotor	Muscle weakness in arms, hands, and legs Weak voice volume
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers in a way that is less taxing. • Patient is interested in maintaining safety within the home when transferring and being able to keep up with his friends and family without the need for a high level of assistance. • Patient is interested in accessing his home and being able to move from room to room and from floor to floor. • Patient is interested in maintaining participation in meaningful outdoor activities.

Assistive Technology Recommendations

- The devices for communication were recommended due to the low volume of Avogadro's voice as well as the decrease in his hand strength and endurance.
- The devices for mobility were recommended due to Avogadro's inability to maintain balance, stand, and walk on his own.
- The home modifications were recommended because they allow Avogadro to access all areas of his home.
- The devices for leisure were recommended due to Avogadro's outdoor interest/activities, and his desire to interact with others in those activities.



SECTION 2
COMMUNICATION
ASSISTIVE TECHNOLOGY



Communication Letter Board

A	b	c	d	1	2
E	f	g	h	3	4
I	j	k	l	m	n
O	p	q	r	s	t
U	v	w	x	y	z
5	6	7	8	9	0

www.instructables.com/id/Communication-Board-for-Individuals-with-Disabilit/

Description	This device is aimed towards assisting the user in communicating with others. The user conveys their message by pointing out the correct letters and numbers in the proper sequence. There are non-electric boards in which the user simply points at the letters and numbers they wish to, as well as, electric board which verbal interact with the user.
Price	\$19.99 – \$49.99+ shipping and handling
Source	store.lowtechsolutions.org/e-tran-board/
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Easy to use - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - Takes an extended amount of time for the user to portray their message. - Limits the overall capacity for self-expression.

EHP Intervention Strategies	
Establish/Restore	General Application Once an individual with ALS begins to experience difficulties with speech production, this device can be utilized as a means of restoring communication by allowing them to express thoughts and feelings with others via the board.
	Case Study Application This device can be utilized to restore Avogadro's ability to communicate with his family and friends by using his hands to point to letter/numbers on the board.
Alter	General Application This device can be utilized in a variety of settings (individuals home, public settings) due to its portability and convenience.
	Case Study Application This intervention strategy will not be used with Avogadro since he will only use this device when at home.
Adapt/Modify	General Application If the individual begins to lose function in their fingers, the board can be modified to have larger squares to make it easier for the user to identify which area they are pointing. The device can also be strapped down to their wheelchair or another surface for support as well.
	Case Study Application This device can be modified with larger squares and a wheelchair mount to compensate for Avogadro's upper extremity weakness and lack of endurance.
Prevent	General Application This device can be utilized to prevent social isolation, boredom, and depression by providing the individual with a means of communicating with others.
	Case Study Application This device can be utilized to prevent isolation, depression, and the inability for Avogadro to communicate with his family and friends.

Communication Picture Board



www.attainmentcompany.com/gotalk-9

Description	This device is aimed towards assisting the user in communicating with others. The user conveys their message by pointing out the picture that corresponds accurately. There are non-electric boards in which the user simply points at the picture they wish to, as well as, electric board which verbal interact with the user.
Price	\$19.99 – \$49.99+ shipping and handling if ordered online
Source	store.lowtechsolutions.org/e-tran-board/ Also available at several other online Augmentative and Alternative Communication websites.
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Easy to use - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - Takes an extended amount of time for the user to portray their message. - Limits the overall capacity for self-expression.

EHP Intervention Strategies

Establish/Restore

General Application

When an individual with ALS cannot produce speech and no longer has the endurance to write every sentence on a piece of paper or whiteboard. They can utilize this device to restore their ability to communicate with others.

Case Study Application

Restores Avogadro's ability to communicate with his family and friends by compensating for his increased upper extremity weakness and lack of endurance.

Alter

General Application

The social context can be altered in regard to this device by utilizing it in one on one situations or in small groups, rather than large group settings.

Case Study Application

Avogadro could use this device when in a small sized restaurant with a quiet atmosphere with his family and the staff.

<p>Adapt/Modify</p>	<p style="text-align: center;">General Application</p> <p>If the individual begins to lose function in their fingers, the board can be modified by increasing the size of the boxes making it easier for the user to identify them. Boards can be modified to contain different pictures for different events to best match the context. The device can also be strapped down to their wheelchair or another surface for support as well.</p>
	<p style="text-align: center;">Case Study Application</p> <p>In regard to Avogadro, this device can be modified to best meet his diminishing upper extremity strength and endurance by increasing the size of the boxes on the board and by mounting the device to his wheelchair.</p>
<p>Prevent</p>	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent social isolation, boredom, and depression by providing the individual with a means of conversing with others. By using this device, the individual is able to express himself or herself in a modified fashion.</p>
	<p style="text-align: center;">Case Study Application</p> <p>In regard to Avogadro, this device can be utilized to prevent excess fatigue within his upper extremities, as well as, isolation from his family by allowing them to communicate.</p>

TrackerPro



www.enablemart.com/trackerpro

Description	The TrackerPro is a high-resolution intelligent camera that provides smooth, reliable operation of a computer mouse. It was designed for individuals with limited hand use.
Price	TrackerPro-\$998 TrackerPro Reflective Dots (100 ct.)-\$27.10 Total: \$1,025.10
Source	www.enablemart.com/trackerpro
Features/Pros	<ul style="list-style-type: none"> -High-resolution camera provides smooth operation -Uses a USB port on any computer -Can integrate the use of switches for “clicking” -Reflective dots can be placed on glasses or a hat. -Easy to use
Cons	<ul style="list-style-type: none"> -Cost -Need to use reflective dots to operate -Need additional software or switches for “clicking function” -Separate payment for reflective dots

EHP Intervention Strategies	
Establish/Restore	General Application This device will allow the individual to use a computer mouse, with an onscreen keyboard an individual with ALS would be able to communicate through text and would be able to create documents for employment using only head movements.
	Case Study Application This device will restore Avogadro's ability to complete computer tasks for employment.
Alter	General Application This device can be used in a home or work environment. In a work environment, an individual would be better able to communicate with fellow co-workers.
	Case Study Application Avogadro will use this device in his work environment. He can use it to complete work related tasks and communicate in a way that all of his co-workers would be able to understand.
Adapt/Modify	General Application The nature of this device is to adapt the way a person can use a computer mouse, through head movements. The device tracks a reflective dot that is placed on an individual's head; the movement of the dot is translated into computer mouse movements.
	Case Study Application Avogadro will use this device to modify how he completes work related tasks and how he communicates with his fellow co-workers.
Prevent	General Application This device can prevent social isolation and depression of an individual with ALS.
	Case Study Application Avogadro will use this device to communicate with co-workers and engage in work related tasks, therefore preventing social isolation, and depression.

Voice Amplification Device

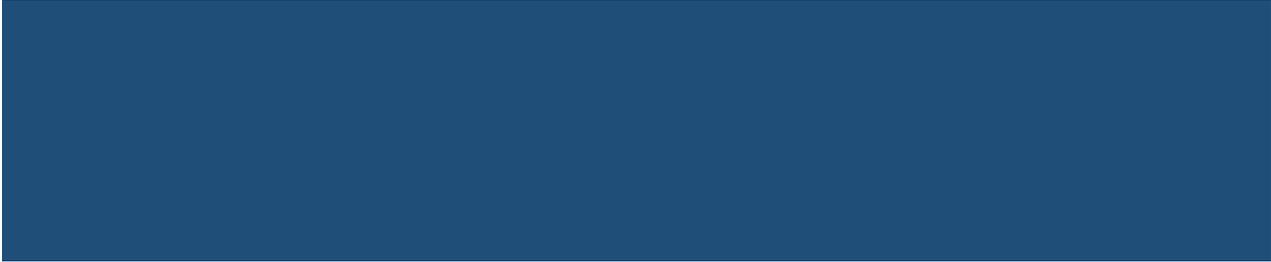


www.harriscomm.com/sonivox-plus-speech-amplifier.html

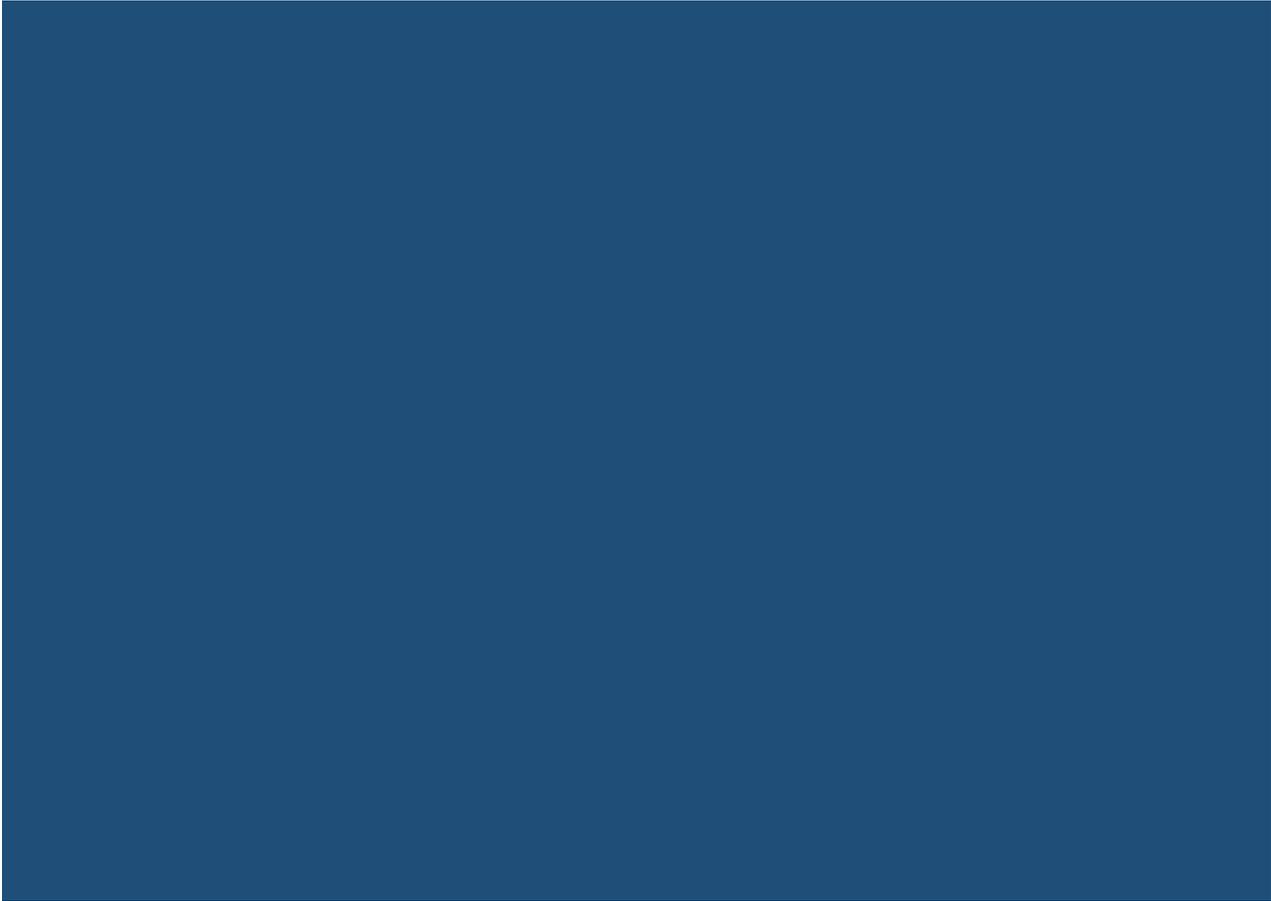
Description	Lightweight and portable speech amplification device for communication. This is a relatively basic communication device when compared to other options such as iPad or eye-gaze system. It works great for individuals who have a hard time speaking loud enough due to diminished musculature associated with speech production. The volume on these devices are adjustable to meet the needs of the user. There are many different variations of this device to fit the needs of the user.
Price	\$200.00-\$300.00+ shipping and handling if purchased online
Source	www.harriscomm.com/equipment/speech-assistance.html Also available at some general electronic stores such as Best Buy and Radio Shack.
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Multiple options to suit the needs of the user. -Adjustable volume to match the contextual requirements.
Cons	<ul style="list-style-type: none"> - May require batteries - Slightly expensive for what you get - May draw unwanted attention

EHP Intervention Strategies	
Establish/Restore	General Application
	If an individual with ALS begins to present with weak musculature associated with speech production they can increase their performance range in this area by utilizing this device. This device will function to restore the individual’s speech producing abilities in regard to volume and allow them to converse with others regardless of muscle weakness.
	Case Study Application
	Avogadro is experiencing difficulty with the volume of his voice making it difficult for family members to hear him. This device can be utilized to restore his ability to speak at an adequate volume when interacting with his family.
Alter	General Application
	This device can be used in a larger or louder environment to ensure that others can hear spoken communication.
	Case Study Application
	Avogadro has a low volume voice, he can use this device to increase his voice volume when communicating with his family, friends, and co-workers in any environment.
Adapt/Modify	General Application
	This device can be adapted/modified in a variety of ways to best meet the needs and performance abilities of the individual. The device can be operated through a hand control, a head mounted control, or a wheelchair mounted control. The volume on the device can also be adapted to meet the needs of the user.
	Case Study Application
	Avogadro is also experiencing a decrease in his hand strength/endurance, so this device can be modified to compensate for this by installing a head mounted control set to operate the device.

Prevent	<p style="text-align: center;">General Application</p> <p>This device can prevent social isolation, depression, and boredom of an individual with ALS. When an individual is able to communicate with another person regardless of their weak speech producing musculature the chance of social isolation and depression decreases greatly.</p>
	<p style="text-align: center;">Case Study Application</p> <p>By enabling Avogadro to communicate properly with his family this device can be utilized to prevent social isolation and depression, as well as, a decrease in his performance range.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device promotes effective communication by increasing the volume of anyone's voice in a loud or large environment.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro has a low volume voice, he can use this device to increase his voice volume when communicating with his family, friends, and co-workers in any environment.</p>



SECTION 2
MOBILITY
ASSISTIVE TECHNOLOGY



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values outdoor activities, family bonding time, and maintaining a sense of identity.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years; additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the middle stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in arms, hands, and legs Weak voice volume
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers in a way that is less taxing. • Patient is interested in maintaining safety within the home when transferring and being able to keep up with his friends and family without the need for a high level of assistance. • Patient is interested in accessing his home and being able to move from room to room and from floor to floor. • Patient is interested in maintaining participation in meaningful outdoor activities.

Assistive Technology Recommendations

The devices for mobility were recommended due to Avogadro's inability to maintain balance, stand, and walk on his own.

Gait Belt



www.posey.com/products/therapy-and-ambulation/gait-belts/6524-r-6524-r-posey-white-gait-belt-standard



www.ocelco.com/store/pc/MRI-Non-Magnetic-Transfer-Gait-Belt-p13096.htm

Description	A device constructed from sturdy cotton that is used to transfer an individual from one position to another or from one seated position to another. It can also be used to help individuals with poor balance while ambulating.
Price	\$6.82+ shipping and handling
Source	www.vitalitymedical.com/washable-cotton-gait-belts.html Any medical equipment supply store
Features/Pros	<ul style="list-style-type: none"> -Length- 52" -Available in longer lengths if individual is larger -Available in a variety of colors -Metal buckle
Cons	<ul style="list-style-type: none"> -Requires some training to use -Requires another person to be present -May need larger size belt depending on size of individual.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to restore an individual’s ability to transfer safely from one surface to another when another person is present.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device to restore his ability to transfer from one surface to another reducing the risk of falling. For example, he can have his wife help him transfer from his bed to his wheelchair with a reduced risk of falling and increased support from another person.</p>
Alter	<p align="center">General Application</p> <p>This device can be used in a variety of contexts for performing safe transfers.</p>
	<p align="center">Case Study Application</p> <p>This strategy would not be used with Avogadro since he will use this device only when at home. He will use other means for safe transfer when in the community or at work such as a sliding board.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>This device can be used modify the way that an individual transfers from one surface to another.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to transfer safely from one surface to another. His wife can help him transfer from the bed to his wheelchair or from his wheel chair to a couch.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device prevents risk of injury, and social isolation for an individual with ALS. This device prevents social isolation by allowing an individual to transfer from one surface to another, which in turn, allows them to mobilize thus allowing social participation.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to safely transfer from one surface to another with the aid of another person he will greatly reduce his risk of falling. When he does transfer into a wheelchair, he will be able to engage socially with other throughout his day.</p>

Sliding Board



www.easierliving.com/maple-transfer-board.html?gclid=Cj0KEQjw4_DABRC1tuPSpqXjxZwBEiQAhMIp6z9oz_ol1t1aNbz3--d3TgS8bmJjZncysUfUIZzheOQaAtHN8P8HAQ

Description	This piece of equipment is lightweight and portable, so it may be transferred easily with the user. The device has slanted edges on both side to reduce friction and make the transferring process slightly easier. It also has hand holes carved out in the middle of the board to allow the user to grab it easily while transferring. Comes in different styles to best meet the needs of the user.
Price	\$60.00 - \$250.00 +Shipping and Handling if purchased online
Source	www.easierliving.com Also available at some medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Light weight - Portable - Easy to use - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - Takes some practice to learn how to properly use the device - Puts the user at a slightly higher risk for experiencing a fall if they have impaired trunk control.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>If an individual with ALS lacks adequate lower extremity strength, but still possesses adequate upper extremity strength, they can utilize a sliding board to restore their ability to transfer from surface to surface safely.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can utilize this piece of equipment to restore his ability to safely transfer from surface to surface without requiring much physical exertion from his lower body. This device will be very helpful considering his lack of ability to stand on his own.</p>
Alter	<p align="center">General Application</p> <p>This device can be used in a variety of physical contexts.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device anywhere that he goes and to transfer to and from almost any surface. For example, Avogadro can use this device to transfer from his bed to his wheelchair or from his vehicle to his wheelchair.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>The sliding board can be adapted to meet the physical context associated with the various surfaces the user frequently transfers to and from. The shape of the board can be customized and additional hand holes and straps can be added for improved maneuverability.</p>
	<p style="text-align: center;">Case Study Application</p> <p>The sliding board can be modified to meet the physical contexts associated with Avogadro's home, work, and community environments to make transferring more efficient.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent pressure ulcers by allowing the individual the opportunity to relieve pressure and transfer from a hard surface to a softer surface. It can also prevent falls.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device can be utilized with Avogadro to prevent the possibility of developing pressure ulcers since he will be sitting for longer periods of time than he is typically used to. He is experiencing difficulty with standing, so this device can also be used to prevent him from falling when he transfers from surface to surface.</p>

Power Assist Wheelchair



www.vitalitymedical.com/e-motion-m15-wheelchair-power-assist.html

Description	Power Assist is an add-on feature that is available on many manual wheelchairs. It allows the user to be active without putting continuous stress on their upper extremities. It reduces repetitive stress injuries, which helps the user to maintain their independence for a long time span. It is also a great piece of technology to assist with energy conservation. The user initiates the movement of the manual wheelchair, but the power assist devices located on the wheels kicks in and continues the movement for the user.
Price	\$3000 - \$6000 +Shipping and Handling if purchased online
Source	www.vitalitymedical.com Also available at some medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Mounts right on to the wheelchair. - Great device to bridge a normal manual wheelchair and a high tech power wheelchair. - Reduces stress on user's upper extremities and conserves energy.
Cons	<ul style="list-style-type: none"> - Slightly expensive. - Learning how the device operates takes some getting used to. - Needs to be charged in order to work properly. - Adds weight to the wheelchair.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to restore an ALS patient’s ability to travel around properly with minimal physical exertion.</p>
	<p align="center">Case Study Application</p> <p>This device can be used to restore his ability to travel extended distances in his wheelchair while compensating for the weakness in his arms.</p>
Alter	<p align="center">General Application</p> <p>This device can be used in a variety of physical contexts.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device in his home, at work, or in the community. This device allows him to maneuver around his environment with minimal effort.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>Depending on the strength and endurance of the user, the power assist device can be modified by varying the amount of horsepower the device transfers to the wheelchair. The amount of horsepower can be increased or decreased to best meet the strength/endurance of the user.</p>
	<p style="text-align: center;">Case Study Application</p> <p>As Avogadro's strength and endurance continues to diminish, this device can progressively be modified to suit Avogadro's needs by incrementally increasing the horsepower it transfers to the wheelchair. This will accommodate for his lack of endurance and allow him to continue to remain mobile.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent secondary injuries within the fingers, wrist, elbow, and shoulder. It can also be utilized to prevent upper extremity fatigue due to overuse.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device can be utilized to prevent any secondary injuries that Avogadro may be at risk from due to continuously using a wheelchair. It can also be used to prevent Avogadro from having to stay home when his family goes somewhere that would require him to propel his wheelchair a long distance. It can also prevent caregiver burnout by alleviating their responsibility to push him in his wheelchair.</p>

Power Scooter

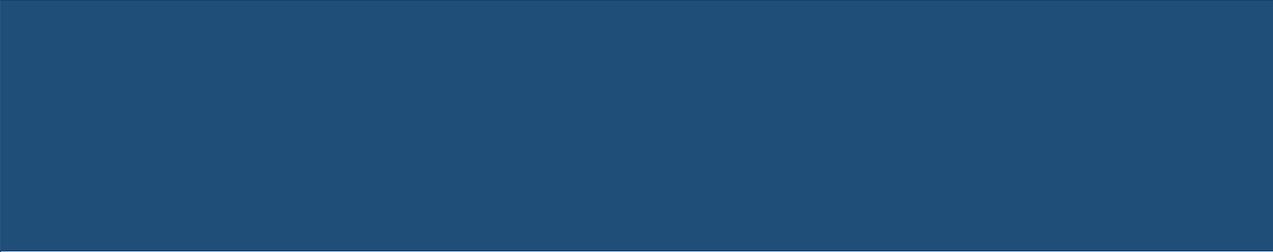


caremotion.com/products/pride-go-go-elite-traveler-4-wheel-travel-scooter

Description	Power scooters are an assistive device that aim to bridge the gap between a manual wheelchair and a full on power wheelchair. This device is capable of folding up for traveling, but not quite to the extent that a manual wheelchair does. The power scooter serves as a great option for mobility for an individual that has limited lower body strength or is seeking a device for energy conservation. It should be noted that insurance companies often will not reimburse their client's for a power scooter. There are a variety of designs to best meet the needs of the user.
Price	\$600.00 - \$2500.00+ shipping and handling if ordered online
Source	www.spinlife.com Also available at some medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> -Bridges the gap between manual wheelchair and full on power wheelchair. -Comes in a variety of styles to meet the needs of the user -Can be used in a variety of setting on a variety of surfaces.
Cons	<ul style="list-style-type: none"> - Relatively expensive - Likely not covered by insurance -Wide turning radius, not as versatile as a power wheelchair.
Note	Insurance will only pay for one mobility device at a time. If an individual wants a scooter and wheelchair, they will have to pay for one of items and insurance will pay for the other.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to restore an ALS patient’s ability to travel around properly with minimal physical exertion.</p>
	<p align="center">Case Study Application</p> <p>As Avogadro's disease progresses, the muscles in his upper and lower body are beginning to weaken more and more. This device can be used to restores his ability to travel extended distances while not require any physical exercise from his upper or lower body.</p>
Alter	<p align="center">General Application</p> <p>This device can be used in a variety of physical contexts.</p>
	<p align="center">Case Study Application</p> <p>Avogadro can use this device when in the community when he is traveling longer distances.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>The scooter can be modified by adding different styles of carrying baskets, or installing different styles of seats to best address the needs of the user and accommodate for their varying skill sets.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro’s scooter can be modified by adding a heavy-duty basket to haul work related materials or any other desires materials with him as he travels. His seat can also be modified to provide him with more postural support.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent secondary injuries within the fingers, wrist, elbow, and shoulder by allowing the scooter to do all of the work for him. It can also be utilized to prevent upper extremity fatigue due to overuse.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device can be utilized to prevent any secondary injuries that Avogadro may be at risk from due to continuously using a wheelchair. It can also be used to prevent Avogadro from having to stay home when his family goes somewhere that would require him to propel his manual wheelchair a long distance.</p>



SECTION 2
HOME MODIFICATIONS



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values outdoor activities, family bonding time, and maintaining a sense of identity.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the middle stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in arms, hands, and legs Weak voice volume
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers in a way that is less taxing. • Patient is interested in maintaining safety within the home when transferring and being able to keep up with his friends and family without the need for a high level of assistance. • Patient is interested in accessing his home and being able to move from room to room and from floor to floor. • Patient is interested in maintaining participation in meaningful outdoor activities.

Assistive Technology Recommendations

The home modifications were recommended because they allow Avogadro to access all areas of his home.

Offset Door Hinges



www.homedepot.com/p/HealthSmart-Black-Expandable-Door-Hinge-Pair-640-2006-1000/203287079?MERCH=REC--NavPLPHorizontal1_rr--NA--203287079--N

Description	This device can be installed on most doors and adds an additional 2 inches to most doorway openings. The hinges help to provide barrier-free access for most wheelchairs.
Price	\$22.00+ shipping and handling if purchased online
Source	www.homedepot.com Also available at most hardware stores.
Features/Pros	<ul style="list-style-type: none"> -The device is cheap -Relatively easy to install -Quick fix to making doorways wheelchair accessible -Available at most hardware stores.
Cons	<ul style="list-style-type: none"> - Requires installation - May not fit all potential doors/doorways.

EHP Intervention Strategies	
Establish/Restore	<p>General Application</p> <p>Virtually all individuals diagnosed with ALS will eventually end up utilizing a wheelchair to maintain their mobility. Many times the doorways within their homes make it difficult for them to get through in their wheelchair due to lack of space. This device can be utilized with this population to establish a means for them to get through the doorways in their home without struggle.</p>
	<p>Case Study Application</p> <p>Avogadro’s home will likely have some doorways that are difficult to get through, so this device could be utilized with him to establish a means to get through his doorway by increasing the room in the doorway.</p>
Alter	<p>General Application</p> <p>The physical context could be altered for an individual with ALS in regard to this device by having them move to a new home that already has offset door hinges standardly installed.</p>
	<p>Case Study Application</p> <p>Avogadro wishes to stay in his current home environment, so the alter strategy is not applicable for him.</p>
Adapt/Modify	<p>General Application</p> <p>This device is technically considered a modification so it cannot be modified further.</p>
	<p>Case study application</p> <p>This device is technically considered a modification so it cannot be modified further.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device could be utilized with an individual who has ALS to prevent them from not being able to get through their doorway with their wheelchair. Essentially this device can be used to prevent the individual from not being able to engage in occupations that require moving freely from room to room in their wheelchair.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro will need to be able to move freely from room to room in order to complete his various occupations at home, so this device can be utilized to prevent him from not being able to move freely in his wheelchair from room to room to complete his desired occupations.</p>
Create/Promote	<p style="text-align: center;">General application</p> <p>This device creates easier access to rooms for anyone. It allows for larger objects to pass through the door such as a bike, garbage can on wheels, groceries, and furniture.</p>
	<p style="text-align: center;">Case study application</p> <p>Avogadro will be able to use the extra space created by this device to easily access all of the rooms in his house with his wheelchair.</p>

Wheelchair Ramp



www.usarampstore.com/prairie-view-industries-modular-xp-ramp-w-handrails-42-inches-wide/

Description	This piece of equipment may be utilized to assist an individual in entering a variety of settings including, but not limited to their home, a friend's home, a vehicle, a deck, or a department store. This device comes in a variety of styles to best meet the needs of the user and match the environment. Many of the styles can be folded up for easy portability.
Price	\$100.00 - \$500.00+ shipping and handling if ordered online
Source	www.usarampstore.com/prairie-view-industries-modular-xp-ramp-w-handrails-42-inches-wide/ Also available at some medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Relatively light weight - Portable - Easy to use - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - Potentially unsafe if not used properly - Depending on the model, it may be slightly cumbersome to transport to other settings.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be utilized with an individual who has ALS and requires a wheelchair for mobility to establish a new way for them to enter their home or vehicle with their wheelchair.</p>
	<p align="center">Case Study Application</p> <p>This device can be utilized with Avogadro to establish a means for him to enter his home or vehicle now that he is wheelchair bound the vast majority of his day.</p>
Alter	<p align="center">General Application</p> <p>The physical context could be altered in regards to this device by having the individual move to a new home that already has built in ramps for accessing the home.</p>
	<p align="center">Case Study Application</p> <p>The alter strategy is not applicable with Avogadro because he has stated that he wants to remain in his own home.</p>
Adapt/Modify	<p align="center">General Application</p> <p>This device could be modified to increase its safety and efficacy by installing reflective strips or lights on it so the user can see where they are going even at night.</p>
	<p align="center">Case Study Application</p> <p>Since Avogadro is still active in the community and work, he may be getting home a little late at times so this device could be modified to increase his safety by installing reflective strips or lights on it to make it easier to see at night.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized with an individual who has ALS to prevent the lack of ability to enter their home or vehicle. It also prevents excess dependency on caregivers for assistance.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device could be utilized with Avogadro to prevent a lack of ability to enter his home with his wheelchair and excess dependency on his family for assistance.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device promotes easier access to any building for everyone.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to promote easier access into his home.</p>

Threshold Wheelchair Ramp



www.discounttramps.com/thresh_ramps/p/Thresh/

Description	This piece of equipment is utilized to assist the individual in transferring over thresholds with their wheelchair both within their home setting and out in a public setting if needed. The device is similar to a wheelchair ramp, but much smaller as it is intended for crossing thresholds only. The ramps come in a variety of styles to meet the needs of the user and match their physical context.
Price	\$25.00 - \$100.00+ shipping and handling if ordered online
Source	www.discounttramps.com Also available at some medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Relatively light weight - Portable - Easy to use - Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> - Potentially unsafe if not used properly - May not be a “one size fits all” type of device.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be utilized to establish a means for an individual that uses a wheelchair to safely transition into environments without having to worry about getting over an elevated threshold.</p>
	<p align="center">Case Study Application</p> <p>Avogadro's home has several rooms with elevated thresholds so this device can be utilized to establish a means for him to travel over those thresholds in a safe manner.</p>
Alter	<p align="center">General Application</p> <p>The physical context could be altered by having the individual move to an environment that already has even surfaces throughout all rooms.</p>
	<p align="center">Case Study Application</p> <p>Since Avogadro wants to stay within his home setting the alter strategy is not applicable.</p>
Adapt/Modify	<p align="center">General Application</p> <p>This device can be modified by building it up or lowering it down to adapt to the physical environment associated with the rooms' threshold.</p>
	<p align="center">Case Study Application</p> <p>In regard to Avogadro, this device can be adapted to properly fit the various thresholds present within his home environment in order to allow safe mobility from room to room.</p>
Prevent	<p align="center">General Application</p> <p>This device can be utilized to prevent physical isolation, lack of access to various rooms, and excess caregiver dependency within individuals diagnosed with ALS that use a wheelchair.</p>
	<p align="center">Case Study Application</p> <p>This device can be utilized with Avogadro to prevent isolation to only certain rooms within his home environment, as well as, over-dependency on his wife and kids to help it move freely from room to room.</p>

Automatic Door Opener



opensesamedoor.com/?gclid=Cj0KEQjwhvbABRDOP4rahNjh-tMBEiQA0QgTGuSLkL-IgWEklRirGUQdfs6qgNTJhb9qXRCMU6coWx4aAvDe8P8HAQ

Description	This piece of equipment is meant to open doors automatically, so the user doesn't need to have a great deal of upper extremity strength and coordination. It is also useful as an energy conservation strategy. The device is installed at the top of the user's door and typically requires a button to be pushed or a visual sensor.
Price	\$500.00 - \$1500.00+ shipping and handling if ordered online
Source	opensesamedoor.com Also available at some specialty medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - Make the users home or rooms within the home easily accessible. - Easy to use once it's installed - Conserves energy for the user. - Increased independence for the user.
Cons	<ul style="list-style-type: none"> - May be relatively expensive - May require an outside source to install the device. - May require maintenance.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>Once an individual with ALS begins using a wheelchair or presenting with diminished upper extremity strength this device can be utilized to restore their ability to open doors within their home environment.</p>
	<p align="center">Case Study Application</p> <p>This device can be utilized to restore Avogadro's ability to enter his home and move around freely from room to room without assistance from his wife or kids.</p>
Alter	<p align="center">General Application</p> <p>The physical environment could be altered related to this device by having the individual move to a home that already has automatic doors installed.</p>
	<p align="center">Case Study Application</p> <p>Avogadro wishes to remain in his home context so this strategy is not applicable for him.</p>
Adapt/Modify	<p align="center">General Application</p> <p>If the small button linked with the device becomes too difficult to operate the device can be modified to open through a visual sensor or through use of a larger button.</p>
	<p align="center">Case Study Application</p> <p>This device can be modified to accommodate for Avogadro's lack of upper body strength and endurance by switching to a motion sensor to activate the doors.</p>

Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent lack of self-esteem and over-dependency on caregivers and overexertion in non-essential tasks.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device can be utilized to prevent over-dependency on Avogadro's family members by allowing him to enter his home and move around freely from room to room without their assistance.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device creates easier access to rooms for anyone. It allows anyone to access a room without any effort on opening or closing the door.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can use this device to enter a room with his wheelchair without any effort to open or close the door.</p>

Stair Lift



www.stair-lifts-101.com/all-stair-lifts/?gclid=Cj0KEQjwhvbABRDOp4rahNjh-tMBEiQA0QgTGkIr7Jh3N2Bx3XCjIfq40y0E6weXeYWVfwCOBBw2ToaAiXZ8P8HAQ

Description	This piece of equipment can be utilized by an individual to get from one level of a home to the next without use of the lower extremities. It works well for anyone with diminished lower extremity function, and can be an energy conservation strategy. It comes in a variety of styles to meet the needs of the user and match the physical context of the environment. It works with regular staircases, wrap around staircases, and outdoor staircases.
Price	\$1100.00 - \$6300.00+ shipping and handling if ordered online
Source	www.usmedicalsupplies.com Also available at some specialty medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> -Works as a great energy conservation strategy. -Transfers the user from floor to floor without functional use of the lower extremities. -Comes in a variety of styles to meet the needs of the user
Cons	<ul style="list-style-type: none"> -May require maintenance. -Can be very expensive. -If the individual requires a wheelchair they are unable to transfer it with them from floor to floor with use of the stair lift.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>Once an individual with ALS loses their ability to functionally weight bear on their lower extremities this device can be utilized to restore their ability to transfer to different floors by accommodating for their lack of muscular strength and endurance in their lower extremities.</p>
	<p align="center">Case Study Application</p> <p>Due to Avogadro's lack of ability to weight bear on his legs this device can be utilized to restore his ability to transfer from floor to floor within his home environment. It can also restore Avogadro's ability to sleep in his bed with his wife upstairs rather than sleeping in the recliner downstairs.</p>
Alter	<p align="center">General Application</p> <p>The physical environment could be altered by having an individual with ALS move into a home that already has a staircase lift installed.</p>
	<p align="center">Case Study Application</p> <p>Avogadro wishes to remain in his home setting so the alter strategy is not applicable to his situation.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>This device can be modified to meet the needs of the user by adding straps, harnesses, armrests, or other features to best meet needs and abilities of the user.</p>
	<p style="text-align: center;">Case study application</p> <p>In regards to Avogadro, this device can be modified to accommodate for his decreasing postural control by installing chest and torso harnesses to keep him safely positioned in the chair while it moves from floor to floor.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device can be utilized to prevent disruptions in the individuals' roles and routines, as well as, isolation to a single floor within their home environment.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device could be utilized with Avogadro to prevent him from having to sleep on the recliner downstairs instead of in his own bed with his wife in their bedroom on the second floor.</p>

Staircase Wheelchair Lift



www.butlermobility.com/

Description	This piece of equipment can be utilized to transfer an individual in their wheelchair from one floor to another floor. It differs from a normal stair lift in that the individual does not need to get out of their wheelchair and into a stair lift chair. The individual can simply wheel onto the platform and go. It comes in a variety of styles to best meet the needs of the user.
Price	\$1600.00 - \$4000.00+ shipping and handling
Source	butlermobility.com/ Also available at some specialty medical equipment supply stores.
Features/Pros	<ul style="list-style-type: none"> - The individual does not need to leave their wheelchair to utilize the device. - Comes in a variety of styles to meet the needs of the user - Works great as an energy conservation strategy. - Increases the individuals overall independence within their home environment.
Cons	<ul style="list-style-type: none"> - The device can be quite expensive. - The device may require maintenance.

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>Once an individual with ALS begins using a wheelchair within their home this device can be utilized to restore their ability to transfer from floor to floor without assistance from a caregiver.</p>
	<p align="center">Case Study Application</p> <p>Since Avogadro is unable to get around on his own without use of a wheelchair he will likely remain in his wheelchair while getting around his house. This device can be utilized with Avogadro to restore his ability to travel around every room on each floor of the house without assistance from his family.</p>
Alter	<p align="center">General Application</p> <p>The physical context could be altered by having the individual move to a single floor home or a home that has a built in wheelchair lift.</p>
	<p align="center">Case Study Application</p> <p>Since Avogadro wants to stay in his own home the alter strategy is not applicable in this case.</p>

<p>Adapt/Modify</p>	<p style="text-align: center;">General Application</p> <p>If an individual is uncomfortable with the lift or would like a heightened level of safety, they can modify the device in a variety of ways. They can add colorful tape to mark the exact spot where the wheelchair should be when moving. They can also add strap or hooks to the device that secure the wheelchair in place while moving.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro family worries about his level of safety when getting around the house, so this device could be modified by adding colorful tape to make proper placement, and hooks or straps for security when the device is operating in order to increase safety and peace of mind.</p>
<p>Prevent</p>	<p style="text-align: center;">General Application</p> <p>This device can be utilized with an individual who primarily gets around in wheelchair to prevent isolation to a single floor within their home. It can also be utilized to prevent lack of occupation engagement with occupations that need to be completed on the second floor of the home.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro has been sleeping in a recliner on the first floor of the home because he is unable to get his bedroom on the second floor with his wheelchair. This device could be utilized with Avogadro to prevent him from having to change his routine of sleeping in his bed with his wife.</p>



**SECTION 2
LEISURE
ASSISTIVE TECHNOLOGY**



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values outdoor activities, family bonding time, and maintaining a sense of identity.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the middle stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	Muscle weakness in arms, hands, and legs Weak voice volume
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers in a way that is less taxing. • Patient is interested in maintaining safety within the home when transferring and being able to keep up with his friends and family without the need for a high level of assistance. • Patient is interested in accessing his home and being able to move from room to room and from floor to floor. • Patient is interested in maintaining participation in meaningful outdoor activities.

Assistive Technology Recommendations

The devices for leisure were recommended due to Avogadro's outdoor interest/activities, and his desire to interact with others in those activities.

Raised Garden Beds



www.homedepot.com/b/Outdoors-Garden-Center-Raised-Garden-Beds/N-5yc1vZbx7c

Description	This piece of equipment is made of 100% western red cedar wood (there are alternative material options). Its height is 32 inches, width is 34 inches, and length is 48 inches. It weighs approximately 72 pounds and is rectangular in shape. The unit can hold approximately 8.9 cubic feet of soil. It essentially raises your garden bed higher up off the ground making it accessible for an individual in a wheelchair or anyone unable to kneel to the ground.
Price	\$80.00 - \$250.00+ shipping and handling if purchased online
Source	www.homedepot.com/b/Outdoors-Garden-Center-Raised-Garden-Beds/N-5yc1vZbx7c
Features/Pros	<ul style="list-style-type: none"> - High quality craftsmanship - Holds a substantial amount of soil - Can be used both inside and outside the home - Makes gardening more accessible for individuals who utilize a wheelchair - 5-year warranty
Cons	<ul style="list-style-type: none"> - Is slightly heavy - Takes up room - Potentially requires maintenance.

EHP Intervention Strategies	
Establish/Restore	General Application This device can be utilized with an individual who has ALS and also views gardening as a meaningful leisure activity. It can restore their ability to engage in gardening while in a seated position.
	Case Study Application Avogadro enjoys engaging in outdoor leisure activities, but is having a difficult time doing so due to his wheelchair. This device could be utilized with Avogadro to restore his ability to engage in outdoor leisure activities such as gardening.
Alter	General Application The alter strategy could be utilized with an individual with ALS in regards to this device by having the individual move to a home that already has built in raised garden beds or by going to an environment that already has raised garden beds.
	Case Study Application Avogadro wishes to remain in his home setting, so this intervention strategy is not applicable.
Adapt/Modify	General Application This device could be modified to best meet the desires of the user by adding risers to make it even higher. It can also be made shorter by cutting the legs if that is desired. Lights could also be added to the device to make it easier to use at night.
	Case Study Application Avogadro is a relatively tall gentleman so this device could be modified to best suit his needs by adding higher legs to increase its height from the ground and better match Avogadro's physical build.

Prevent	<p style="text-align: center;">General Application</p> <p>This device could be utilized with an individual with ALS to prevent boredom, depression, and a decreased quality of life by enabling them to engage in a leisure activity.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Since Avogadro enjoys outdoor activities and his performance range has been decreased since his ALS diagnosis, this device can be utilized to prevent depression, boredom, and an overall decreased quality of life.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>An individual can promote engagement in gardening activities by using this device to reduce joint compression on their knees, shoulders, and back.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro will use this device to continue his engagement in gardening activities from the seated position of a wheelchair.</p>

TRACFAB All-Terrain Tracked Wheelchair



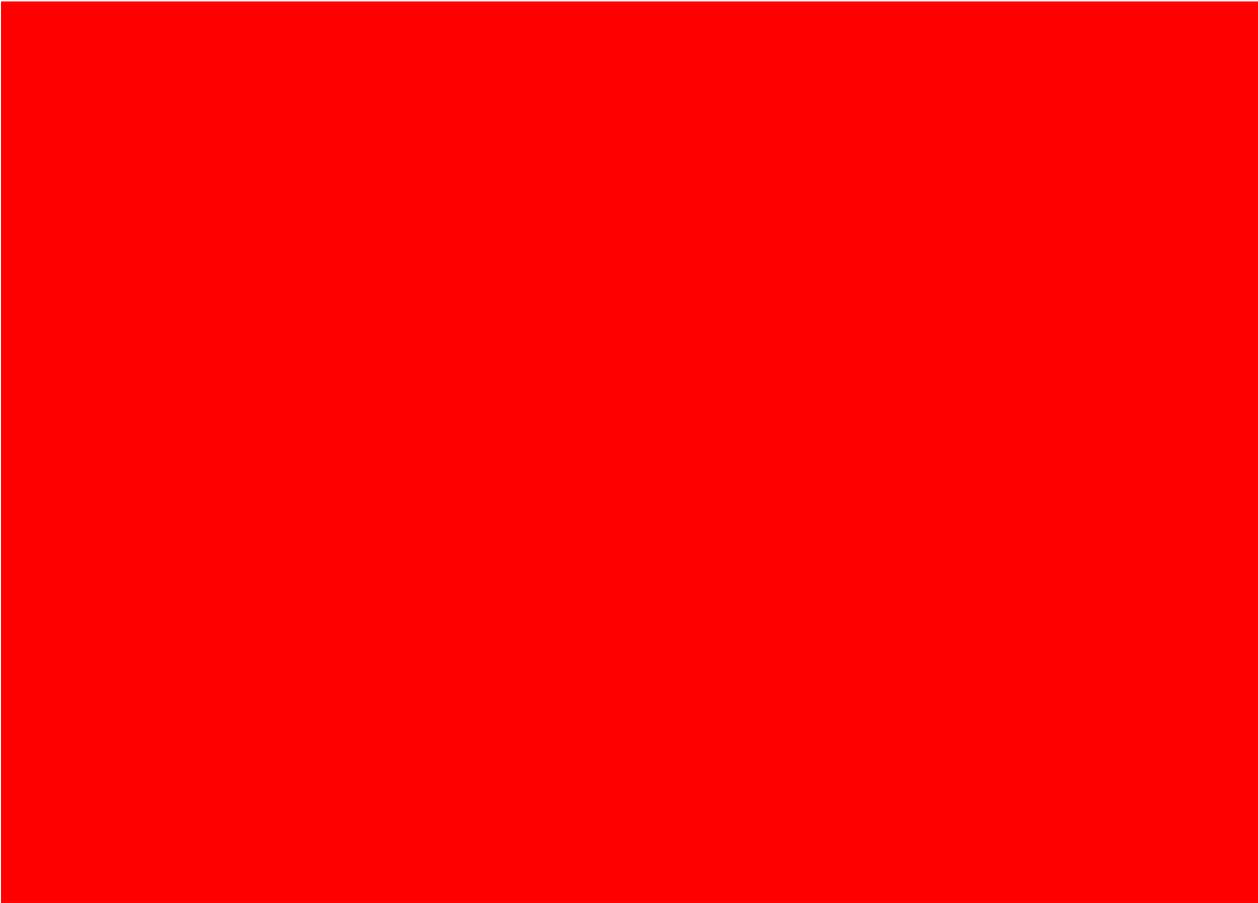
store.tracfab.com/products/tracfab-all-terrain-tracked-wheelchair
www.tracfab.com/home.html

Description	All terrain power wheelchair. Great for the outdoors.
Price	\$14,949+ shipping and handling
Source	www.tracfab.com/home.html
Features/Pros	<ul style="list-style-type: none"> -Heavy gauge steel frame for superior strength -High quality rubber tracks -Flip up armrests -Recline function -Multiple charging options -Great for the outdoorsman- hunting, fishing, camping, hiking -Several attachments are available- multi-axis, shooting platform, fishing rod holder, drink holder, etc. -9 mile range
Cons	<ul style="list-style-type: none"> -Cost -Out of pocket cost-insurance will not pay for this wheelchair -Reduced comfort compared to everyday wheelchair -No tilt function

EHP Intervention Strategies	
Establish/Restore	General Application This tracked wheelchair can be used to restore an individual's ability to participate in outdoor leisure activities such as hiking, hunting, and fishing.
	Case Study Application This tracked wheelchair will restore Avogadro's ability to go hiking, hunting, and fishing with his family.
Alter	General Application This power wheelchair can be used in the community and most likely for outdoor leisure activities.
	Case Study Application Avogadro can use this device in his yard, in the community and in other outdoor settings. This device allows him to maneuver around his outdoor environment regardless of conditions.
Adapt/Modify	General Application This power wheelchair is adapted to several environments. it is capable of going through 8 inches of water, and can travel for 9 miles.
	Case Study Application This device can be used to modify the method in which Avogadro is able to engage in his meaningful outdoor activities. He will be able to select the appropriate attachments that will help him adapt the task to his current abilities. For example, he will be able to mount a power caster on the side of his wheelchair for fishing with his family.
Prevent	General Application This power wheelchair can prevent depression, social isolation, and occupational deprivation
	Case Study Application This tracked power wheelchair will prevent social isolation, depression, and occupational deprivation in Avogadro by allowing him to travel in an outdoor setting and allowing him the freedom to participate in his meaningful outdoor activities.



SECTION 3
LATE STAGE ALS



Case Study 3

Three years later and 3 ½ years post diagnosis, Avogadro and his family returned for another appointment with an OT. The family reports several changes in Avogadro's condition. These changes include, the absence of movement in his legs, upper arms or wrist, a complete inability to weight bear on his feet, difficulties with keeping his body upright, and an inability to speak. The OT conducts an assessment of Avogadro, and discovers that he has a voluntary twitch in his right index finger and can still control his eyes voluntarily. The family reports to the OT that work, movement within the home, communication, and being able to play with his children are his primary concerns. The ability to safely transfer Avogadro, and allow Avogadro independent access to the home and the community are the primary concerns of the family.

Context Variables

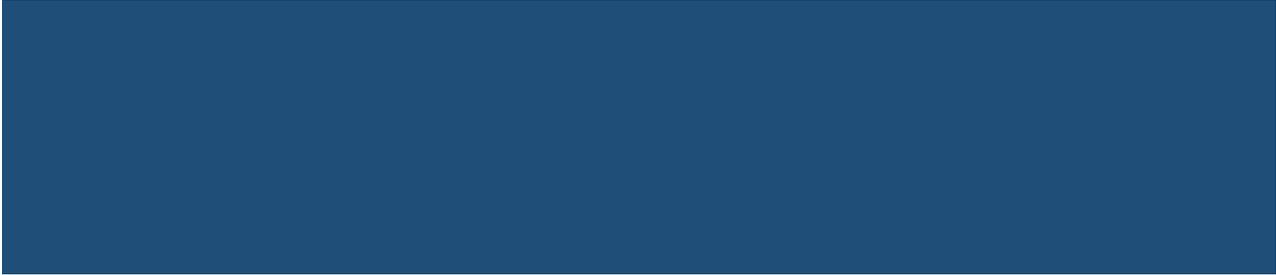
Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values maintaining sense of identity and values previous roles as a husband, father, and provider.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the late stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	No movement in legs, arms, or wrist and no weight bearing Lack of postural control Inability to speak
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers independently. • Patient is interested in maintain safety with transfers and being able to maneuver around his home and community. • Patient is interested in ability to maintain independent mobility and home environment control within his home. • Patient is interested in maintaining employment and playing with his children.

Assistive Technology Recommendations

- The devices for communication were recommended due to Avogadro's inability to speak.
- The devices for mobility were recommended due to Avogadro's inability to weight bear on his feet and absence of movement in his legs, arms, and wrists.
- The home modifications were recommended because they allow Avogadro to access all areas of his home.
- The devices for leisure were recommended due to Avogadro's desire to maintain employment and play with his children.



SECTION 3
COMMUNICATION
ASSISTIVE TECHNOLOGY



iPad



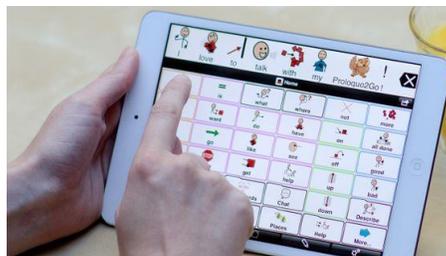
www.apple.com/shop/buy-ipad/ipad-mini-4/128gb-silver-wifi

Description	Small easy to use, portable device with touch screen and accessibility features.
Price	iPad-\$529+ shipping and handling
Source	www.apple.com
Features/Pros	<ul style="list-style-type: none">-Portable-Light-Weight-Smaller than computer-Lasts 10 hours of constant use-Easy to use and set up-Built in accessibility
Cons	<ul style="list-style-type: none">-Cost-No SD card slot-Unable to use USB-based accessories such as memory stick, mouse, or keyboard

EHP Intervention Strategies	
Establish/Restore	General Application
	This device can be used to restore an individual's ability to effectively communicate with others. The iPad will also restore an individual's ability to engage in various leisure activities such as, listening to music, watching videos, and playing games.
	Case Study Application
	This device can be used to restore Avogadro's ability to communicate with his family and friends by compensating for his inability to speak. It can also restore his ability to listen to music, watch videos, and play games.
Alter	General Application
	Due to the portability of the device, it can be used in a variety of contexts.
	Case Study Application
	Avogadro can use this device in his home setting or a community setting. He can utilize this device when at work to communicate with his co-workers or when he is out with his family at a restaurant to communicate with the waiter/waitress.
Adapt/Modify	General Application
	This device can be operated through various means, including touch and a variety of switches including microswitches.
	Case Study Application
	Avogadro can operate this device by placing a microswitch near his right index finger. He would not be able to operate by touch since he does not have arm and wrist control.

Prevent	<p style="text-align: center;">General Application</p> <p>This device can prevent the social isolation, depression, and boredom of an individual with ALS.</p>
	<p style="text-align: center;">Case Study Application</p> <p>By using this device, Avogadro can prevent social isolation and depression. He can also use this device for FaceTime, email, and texting others.</p>
Create/Promote	<p style="text-align: center;">General Application</p> <p>This device can be used for a variety of tasks by anyone regardless of ability, including but not limited to email, texting, FaceTime, listening to music, watching videos, and playing games.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro will be using this device for communication, leisure, and work.</p>

Proloquo2Go



www.assistiveware.com/product/proloquo2go
www.pinterest.com/pin/18225573466998526/

Description	This app is designed to promote language development and grow communication skills. It can be adjusted to support a variety of communication challenges. It is also available in multiple languages.
Price	\$249.99
Source	Apple App Store
Features/Pros	<ul style="list-style-type: none"> -Large customizable vocabulary -Advanced grammar -Can be accessed via touch or microswitch -Easy to edit -Able to Express emotions
Cons	<ul style="list-style-type: none"> -Cost -Can be difficult to navigate -Can be overwhelming and inefficient -May seem childish to some users

EHP Intervention Strategies	
Establish/Restore	General Application This app can be used to restore an individual's ability to effectively communicate with others.
	Case Study Application This app can be used to restore Avogadro's ability to communicate with his family and friends by compensating for his inability to speak.
Alter	General Application The device that this app will be loaded onto is portable. Therefore, this app can be used in a wide variety of settings, including the home setting or community setting.
	Case Study Application Avogadro can use this app in his home setting or in a community setting. He can utilize this device when at work to communicate with his co-workers or when he is out with his family at a restaurant to communicate with the waiter/waitress.
Adapt/Modify	General Application This app can be operated through various means, including touch and a variety of switches including microswitches.
	Case Study Application Avogadro can operate this app by placing a Bluetooth connected microswitch near his right index finger. He would not be able to operate by touch since he does not have arm and wrist control.
Prevent	General Application This app can prevent the social isolation, depression, and boredom of an individual with ALS.
	Case Study Application By using this app, Avogadro can prevent social isolation and depression by having the ability to communicate his thoughts and feelings to his family, friends, and co-workers.

Tobii Dynavox I-15 with Eye Tracking



www.tobiidynavox.com/iseriestplus/

Description	The Tobii Dynavox I-15 is a speech-generating device that enables effective communication in several forms- voice output, environmental control, computer access, and long distance communication.
Price	\$17,485+ shipping and handling
Source	www.tobiidynavox.com/iseriestplus/ www.atclibrary.org/product.php?id=1262
Features/Pros	<ul style="list-style-type: none"> -Durable -Multiple methods of control-touch, switch, or eye gaze -9 hour battery life with constant use- swappable batteries enables all day communication power -Sleep/wake on gaze function -Multiple mounting options. -Compatible with other devices sold by Tobii Dynavox to increase communication abilities, i.e. Skype, Facebook, Twitter etc.
Cons	<ul style="list-style-type: none"> -Cost -Heavy-8.4 lbs. -Need to carry extra batteries for longer talk time. -Add-ons necessary for long distance communication.

EHP Intervention Strategies	
Establish/Restore	General Application This device can be used to restore an individual's ability to communicate effectively with others.
	Case Study Application This device can be used to restore Avogadro's ability to communicate with his family and friends by compensating for his inability to speak.
Alter	General Application Due to the portability of this device, it can be used in a variety of contexts.
	Case Study Application Avogadro can use this device in his home setting or a community setting. He can utilize this device when at work to communicate with his co-workers or when he is out with his family at a restaurant to communicate with the waiter/waitress.
Adapt/Modify	General Application This is a speech-generating device that is operated by eye gaze, touch, or switch. It is also compatible with Facebook, Twitter, and Skype, which allows for greater long distance communication with others.
	Case Study Application Avogadro can operate this device by using his eyes or a microswitch. Eye gaze would be the most appropriate option since it would eliminate excess items, and since it would be less physically draining.
Prevent	General Application This device can prevent the social isolation, depression, and boredom of an individual with ALS.
	Case Study Application This device would allow Avogadro to communicate with his family, friends, and co-workers in a simple and effective way. The methods of control and ease of use would decrease social isolation, risk of depression, and alleviate boredom.



**SECTION 3
MOBILITY
ASSISTIVE TECHNOLOGY**



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values maintaining sense of identity and values previous roles as a husband, father, and provider.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the late stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	No movement in legs, arms, or wrist and no weigh bearing Lack of postural control Inability to speak.
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers independently. • Patient is interested in maintaining safety with transfers and being able to maneuver around his home and community. • Patient is interested in the ability to maintain independent mobility and home environmental control within his home. • Patient is interested in maintaining employment and playing with his children.

Assistive Technology Recommendations

The devices for mobility were recommended due to Avogadro's inability to weight bear on his feet and absent movement in his legs, arms, and wrists.

Hoyer Deluxe Power Lift



www.1800wheelchair.com/product/hoyer-deluxe-power-lift/

www.youtube.com/watch?v=7qQCdxCUsXA

Description	A power lift device that allows a caregiver to safely transfer the patient from one surface to another. Due to the power assist the risk of injury and effort from the caregiver is reduced.
Price	\$1,838+ shipping and handling
Source	www.1800wheelchair.com/product/hoyer-deluxe-power-lift/
Features/Pros	<ul style="list-style-type: none"> -Ergonomic design -Single speed actuator -6-point non-sway cradle -Emergency Stop Button -400 lbs. weight capacity
Cons	<ul style="list-style-type: none"> -Cost -Requires an assistant to operate. -Product weight-84 lbs. -Large in size may not fit well in average bedroom for operation.- closed 24", open 40.5"

EHP Intervention Strategies	
Establish/Restore	General Application This device will help restore an individual’s ability to transfer from one surface to another.
	Case Study Application Avogadro can utilize this device to restore his ability to transfer from his bed to his wheelchair. He will require the help of Maria or one of his children in order to transfer, however this is a safer option for everyone involved.
Alter	General Application In order to use the device an individual may need to move into an assisted living facility or move to more accessible housing.
	Case Study Application The alter strategy does not apply to Avogadro since he is staying in his own home.
Adapt/Modify	General Application An individual with ALS would need to have their environment modified to accommodate the operating space required by this device.
	Case Study Application Avogadro’s family will modify his bedroom to accommodate the large operating space of the Hoyer lift.
Prevent	General Application This device prevents social isolation, depression and injury.
	Case Study Application Avogadro will use this device to prevent social isolation, depression and injury. By allowing Avogadro to get out of bed safely, he is able to engage socially with his friends, family, and co-workers. This also reduces the risk of depression since he will be able to engage in meaningful activities.

Dodge Accessible Van

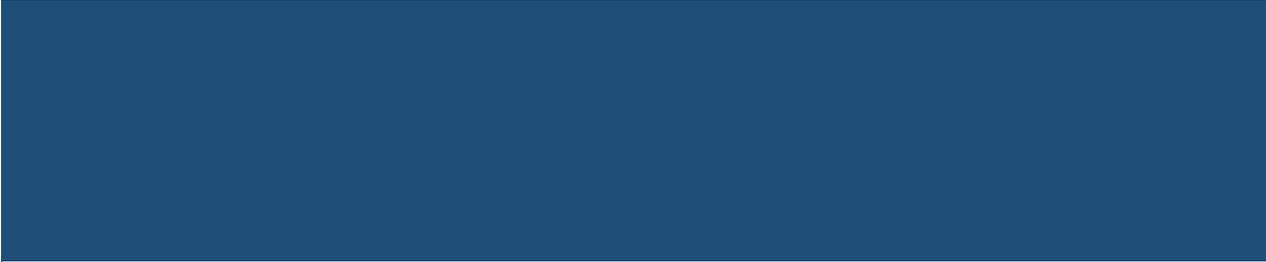


www.braunability.com/wheelchair-vans/dodge-power/

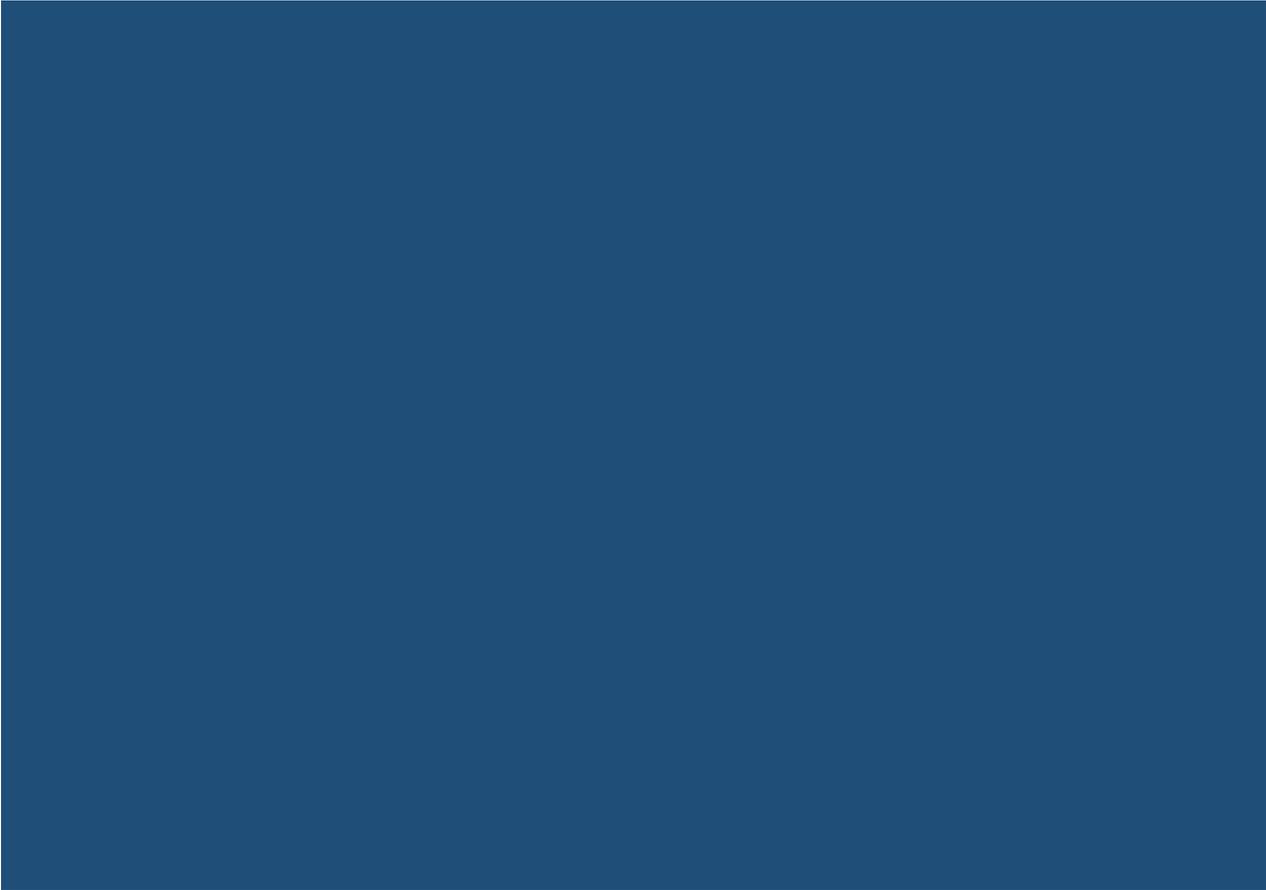
Description	This accessible van offers wide variety of features and is highly customizable. This van will allow an individual with ALS to maintain independence in community involvement once they require a power wheelchair.
Price	≈\$44,500 This price will vary depending on the features, make and model of the vehicle.
Source	www.braunability.com/side-entry-wheelchair-vans/
Features/Pros	<ul style="list-style-type: none"> -Power foldout ramp -Power door & kneel -Keyless remote -Removable seating -9.2 ° ramp angle
Cons	<ul style="list-style-type: none"> -Cost -Delivery can be lengthy -Maintenance

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This vehicle with the appropriate modifications can be used to restore an individual's ability travel within their community. Allowing them to continue to be involved in the community activities that they find meaningful.</p>
	<p align="center">Case Study Application</p> <p>This vehicle will restore Avogadro's ability to travel around his community and engage in the community activities that he finds meaningful.</p>
Alter	<p align="center">General Application</p> <p>An individual can use this vehicle for community mobility. An individual can also use public transportation options such as Dial-A-Ride.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will utilize this vehicle in his community environment and can use it to engage in his social context as well.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>This vehicle has several different options that can be customized to the user’s needs. These options include but are not limited to, entry point, ramp style, seating options, and driving controls.</p>
	<p style="text-align: center;">Case Study Application</p> <p>Avogadro can modify the vehicle to suit his needs. He will utilize a side entry fold up ramp and a removable front passenger seat. This way he can ride in the vehicle with his wife and kids. These modifications would allow Avogadro’s family the freedom to use the vehicle without Avogadro if they needed to.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This vehicle can be used to prevent social isolation and depression.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This vehicle will prevent social isolation and depression by allowing Avogadro to get out of his house and maneuver around his community in a safe manner. Where he will be able to engage in meaningful activities and interact with others.</p>



SECTION 3
HOME MODIFICATIONS



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values maintaining sense of identity and values previous roles as a husband, father, and provider.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the late stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	No movement in legs, arms, or wrist and no weigh bearing Lack of postural control Inability to speak
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers independently. • Patient is interested in maintaining safety with transfers and being able to maneuver around his home and community. • Patient is interested in the ability to maintain independent mobility and home environmental control within his home. • Patient is interested in maintaining employment and playing with his children.

Assistive Technology Recommendations

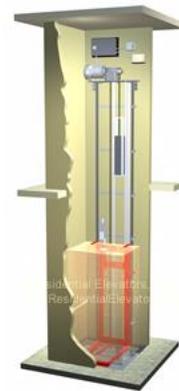
The home modifications were recommended because they allow Avogadro to access all areas of his home.

Residential Elevator



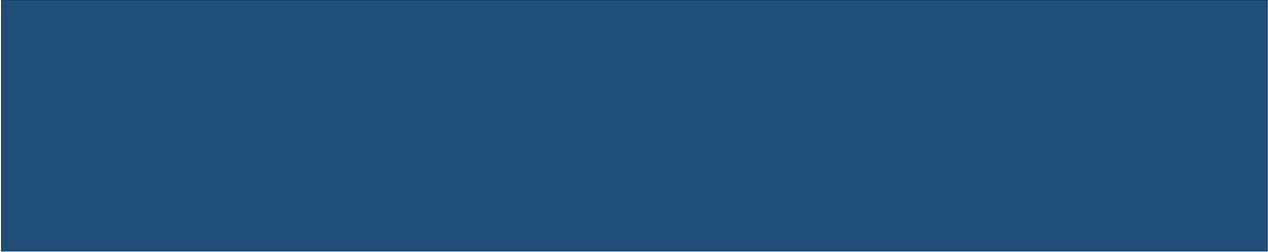
www.residentialelevators.com/cab_designs.htm

www.residentialelevators.com/types.htm



Description	This residential elevator will assist an individual in accessing all parts of their multi-story home.
Price	\$20,000+ depending on options and mechanism chosen
Source	www.residentialelevators.com/index.htm
Pros	<ul style="list-style-type: none"> -Multiple customizable options -950 lbs. capacity -Travel up to 50 feet -Travel speed of 40 feet per minute -Low maintenance required -Recessed lighting
Cons	<ul style="list-style-type: none"> -Cost -Space requirements -Electrical modifications may be required -Noise of operation -Limited space

EHP Intervention Strategies	
Establish/Restore	General Application This elevator can be used to restore an individual’s ability to mobilize inside of their home, allowing them to remain in their multi-story home for as long as they can.
	Case Study Application This modification would restore Avogadro’s ability to mobilize around his house by allowing him full independent access to all areas of his three-story home.
Alter	General Application The physical environment could be altered related to this device by having the individual move to a home that already has an elevator installed.
	Case Study Application Avogadro wishes to remain in his home context so this strategy is not applicable for him.
Adapt/Modify	General Application This modification can be used in any home that is 5 stories or less.
	Case Study Application Avogadro has a three-story home with his bedroom on the second floor. This modification would adapt the method of in which he gets to his bedroom. This modification would be more appropriate with a heavier wheelchair than the wheelchair stair lift since it can hold up to 900 pounds. It would also allow for an attendant to travel with him.
Prevent	General Application This modification can prevent the loss of independence with in home mobility and prevents the need to move out of the home due to inability to access all necessary areas.
	Case Study Application This modification will allow Avogadro to be completely independent with in home mobility, allowing him to traverse each story of his home without assistance.



**STAGE 3
LEISURE
ASSISTIVE TECHNOLOGY**



Context Variables

Types of Context	Observations
Physical	Home, community, and work environment
Cultural	Patient values maintaining sense of identity and values previous roles as a husband, father, and provider.
Social	Micro: Friends, family and co-workers Macro: Right to continue working, ADA rights, access to buildings. Insurance will cover one wheelchair every 5 years, additional funding can come from NDIPAT, ALS association. Alternative funding includes crowdsourcing websites like, gofundme.com and Kickstarter.
Temporal	Middle aged man in the late stage of ALS

Person Variables

Variables	Challenges
Sensorimotor	No movement in legs, arms, or wrist and no weigh bearing Lack of postural control Inability to speak
Processing Skills	Patient does not present with any processing deficits
Interests	<ul style="list-style-type: none"> • Patient is interested in communicating with his family, friends, and co-workers independently. • Patient is interested in maintaining safety with transfers and being able to maneuver around his home and community. • Patient is interested in the ability to maintain independent mobility and home environmental control within his home. • Patient is interested in maintaining employment and playing with his children.

Assistive Technology Recommendations

The devices for leisure were recommended due to Avogadro’s desire to maintain employment and play with his children.

Tab Grabber Tablet Holder



www.wrightstuff.biz/tab-grabber-tablet-holder.html

www.wrightstuff.biz/tab-grabber-table-clamp.html

Description	Allows the wheelchair user to interact with the tablet without needing to hold on to the tablet. The swivel head allows the user to orient the device for optimal viewing and interaction.
Price	Tab Grabber Tablet Holder: \$74.95 Table Clamp for Tab Grabber: \$16.95 Total: \$91.90+ shipping and handling
Source	www.wrightstuff.biz/tab-grabber-tablet-holder.html
Features/Pros	<ul style="list-style-type: none"> -Allows a user to use any size tablet or e-reader without needing to hold on to the device. -Quick installation-15 seconds -18" gooseneck arm -Fits round wheelchair tubing up to 1-1/8 inch diameter -Can mount to wheelchair or table
Cons	<ul style="list-style-type: none"> -Cost -Requires a secondary mounting surface to mount to table -Difficult to place tablet into mounting surface

EHP Intervention Strategies	
Establish/Restore	General Application This device can be used to restore an individual’s ability to engage in multiple leisure activities including reading, gaming, watching videos, and listening to music.
	Case Study Application This device will restore Avogadro’s ability to engage in the valued occupations, of watching videos, listening to music and reading. Avogadro will require assistance to place a tablet into the device, however once it is place in he will be able to engage in the activity of his choosing.
Alter	General Application Due to the portability of this mount, it can be used in a variety of contexts. An individual with ALS can use this mount in a home setting or a community setting.
	Case Study Application This device can be mounted on Avogadro’s wheelchair or a table in his home or work office. This would allow Avogadro to utilize a tablet for reading, listening to music, or watching videos in his home and community settings.
Adapt/Modify	General Application This mount can hold several types of devices, as a one size fits all type mount. The device can be mounted directly to any wheelchair or table for greater portability and functional use.
	Case Study Application This mount will modify the way that Avogadro holds his tablet devices. The device can be mounted on Avogadro’s wheelchair or a table in his home. This would allow Avogadro to utilize a tablet for reading, listening to music, or watching videos in his home and community settings.

Prevent	<p align="center">General Application</p> <p>This mount can prevent the fatigue, social isolation, and depression of an individual with ALS.</p>
	<p align="center">Case Study Application</p> <p>This device will prevent Avogadro from developing fatigue, social isolation and depression. By allowing him to participate in valued occupations conducted by a tablet device.</p>
Create/Promote	<p align="center">General Application</p> <p>This device promotes occupational engagement in meaningful leisure activities associated with a tablet for anyone regardless of ability since it can attach to a table.</p>
	<p align="center">Case Study Application</p> <p>Avogadro enjoys, reading, watching videos, and listening to music. This device will promote his participation and engagement in those valued leisure occupations.</p>

Tobii Dynavox Eyemobile Mini



www.tobiidynavox.com/eyemobile-mini/

www.tobiiati-webshop.com/products/pceye-mini

Description	A compact and lightweight device that allows a user to operate Windows 10 applications such as the internet, movies, music, e-books, social media sites, and games.
Price	\$3,245+ shipping and handling
Source	www.tobiidynavox.com/eyemobile-mini/
Features/Pros	<ul style="list-style-type: none"> -Gives a user the ability to fully participate in school and work by adapting how the user, writes emails, reports, spreadsheets etc. -Eye tracking device is compatible with any device with a USB port. -Eye tracker runs off tablet battery. -Eye tracker replaces keyboard and mouse functions -Compact and lightweight device for easy transport. -Comes with mounting bracket for wheelchair use.
Cons	<ul style="list-style-type: none"> -Cost -Limited to use of only 6 tablets -Not compatible with iOS devices such as iPad

EHP Intervention Strategies	
Establish/Restore	<p align="center">General Application</p> <p>This device can be used to restore communication, employment/leisure based computer work, and environmental control.</p>
	<p align="center">Case Study Application</p> <p>Avogadro cannot use his arms, wrist or hands to use a computer. Due to this, he cannot perform the duties of his employment and has difficulties with leisure engagement. Avogadro can use this device to restore his ability to use a computer and maintain his employment as an accountant.</p>
Alter	<p align="center">General Application</p> <p>This device is compatible with any other device that utilizes a USB port, (tablets, computers, laptops) this allows the device to be used in a variety of contexts. An individual with ALS can use this device in a home setting or a community setting.</p>
	<p align="center">Case Study Application</p> <p>Avogadro will use this device at home, work, and in the community for communication and leisure participation.</p>

Adapt/Modify	<p style="text-align: center;">General Application</p> <p>This device uses eye gaze to replace the keyboard, and mouse of a computer, laptop, or tablet. It can also be used to control one's physical environment (lights, temperature, phone, TV etc.) by interacting with infrared equipped devices.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device allows Avogadro the ability to use eye gaze to control a computer's mouse and keyboard, effectively giving him complete control of a computer. Using this device Avogadro can control his in-home environment as well, controlling the lights, temperature, phone, and TV.</p>
Prevent	<p style="text-align: center;">General Application</p> <p>This device helps prevent social isolation, loss of employment, boredom, dependence on others.</p>
	<p style="text-align: center;">Case Study Application</p> <p>This device will prevent Avogadro from losing his job, and will prevent him from being dependent on others for environmental control.</p>

QuadStick Game Controller



www.quadstick.com/



www.quadstick.com/shop/cronusmax

Description	QuadStick is a mouth operated game controller originally designed for quadriplegics. Utilizes a joystick, 4 sip & puff sensors and a lip sensor for game input
Price	QuadStick: \$399 CronusMax Plus adaptor: \$85 Total: \$484+ shipping and handling
Source	www.quadstick.com/ www.quadstick.com/shop/cronusmax
Features/Pros	<ul style="list-style-type: none"> -Can be operated via joystick, sip & puff, and lip sensors -Can be immediately used with PS3, Android and many PC games that require a joystick, mouse, or keyboard -Also compatible with Xbox 360, Xbox One, and PS4
Cons	<ul style="list-style-type: none"> -Cost -Not compatible with tablet based games -Requires an adaptor to be compatible with Xbox 360, Xbox One or PS4

EHP Intervention Strategies	
Establish/Restore	General Application This device can be used to restore an individual’s ability to participate in the leisure activity of playing video games as well as social participation.
	Case Study Application Avogadro enjoys playing video games with his children, and does so on a regular basis. This device will restore Avogadro’s ability to play video games with his children.
Alter	General Application This device could be used in a variety of physical contexts and across multiple gaming platforms.
	Case Study Application The device is compatible with the PS3 and with the adaptor is compatible with several other platforms. Avogadro will need to purchase the adaptor in order to play his Xbox 360 with his children.
Adapt/Modify	General Application This device allows for multiple methods of input, including, sip and puff, joy stick and lip sensors. An individual with ALS can use this device to operate multiple gaming platforms for a variety of game types.
	Case Study Application Avogadro can use multiple modes of input to control aspects of the video game. He may start playing using the joystick function and as he begins to fatigue he may start to use the sip and puff or lip sensors.
Prevent	General Application This device can prevent the social isolation, depression, and boredom of an individual with ALS.
	Case Study Application This device prevents the development of depression and boredom for Avogadro, as he will be able to participate in a valued leisure activity and he will be able to engage in the activity with his children.



ASSISTIVE TECHNOLOGY AND FUNDING RESOURCES



Additional AT Product and Funding Resources

Below is a list resources that may help an individual with ALS, further research AT and obtain funding for AT.

Funding Resources

Achievement through Technology- Connecticut Tech Act Project

cttechact.com/#sthash.ZBipIGIh.dpbs

Americans with Disabilities Act- www.ada.gov

Minnesota Star Program- mn.gov/admin/star/

North Dakota IPAT- ndipat.org/

Research Resources

Able Data, Tools & Technology to Enhance Life- www.abledata.com/

AgrAbility, Cultivating Accessible Agriculture- www.agrability.org/

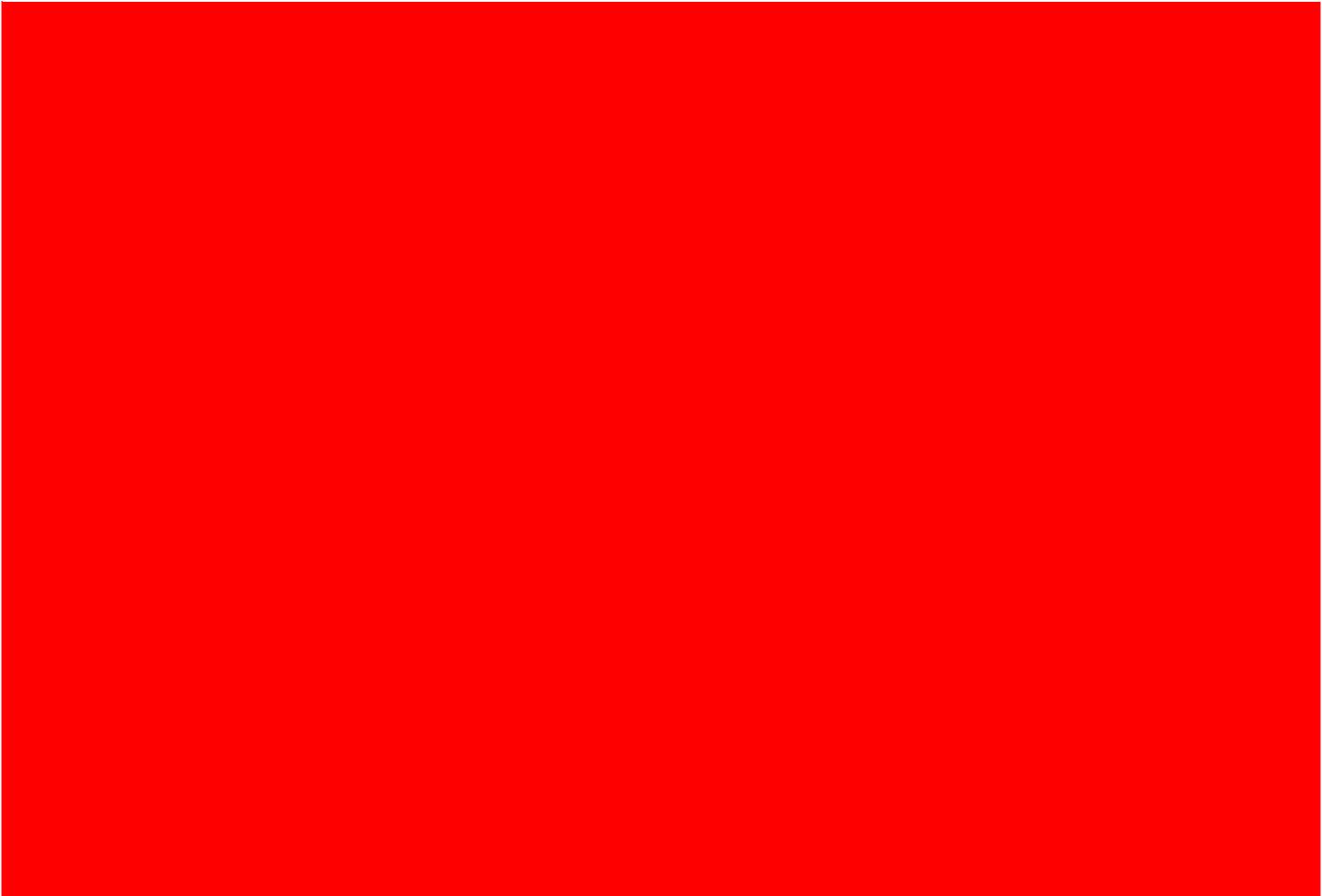
Rehabilitation Engineering and Assistive Technology Society of North America-
www.resna.org/

Wisconsin AT consulting Network-www.wati.org/

Wyoming Institute for Disabilities- <http://www.uwyo.edu/wind/>



RESOURCES & REFERENCES



AT Resources

Section 1 Resources

Adjustable Sink:

freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTSINK

Adjustable Stove:

freedomliftsystems.com/Wheelchair-Accessible-Kitchen/APUADJUSTCOOKTP

Automatic Card Shuffler:

www.adaptivetechsolutions.com/card-shuffler-switch-adapted/

Book Holder:

www.amazon.com/Actto-BST-09-adjustable-Portable-Document/dp/B005IV6U0U/ref=zg_bs_490620011_1

Cane:

www.1800wheelchair.com/product/sky-med-stand-alone-cane/

Forearm Crutch:

justwalkers.com/adult-bariatric-steel-forearm-crutches.html

Magna doodle:

www.target.com

Ultra-light manual wheelchair:

www.spinlife.com

Walker:

www.1800wheelchair.com/category/294/adult-walkers/

White board:

www.usmarkerboard.com

Section 2 Resources

All-Terrain Wheelchair:

www.tracfab.com/home.html

Automatic door opener:

www.opensamedoor.com

Gait Belt:

www.vitalitymedical.com/washable-cotton-gait-belts.html

Letter board:

www.store.lowtechsolutions.org/e-tran-board/

Offset Door Hinges:

www.homedepot.com/p/HealthSmart-Black-Expandable-Door-Hinge-Pair-640-2006-1000/203287079?MERCCH=REC--NavPLPHorizontal1_rr--NA--203287079--N

Picture board:

www.store.lowtechsolutions.org/e-tran-board/

Power-assist wheelchair:

www.vitalitymedical.com

Power scooter:

www.spinlife.com

Raised Garden Beds:

www.homedepot.com/b/Outdoors-Garden-Center-Raised-Garden-Beds/N-5yc1vZbx7c

Sliding board:

www.easierliving.com

Staircase lift:

www.usmedicalsupplies.com

Staircase wheelchair lift:

www.butlermobility.com/

TrackerPro:

www.enablemart.com/trackerpro

Threshold ramp:

www.discountramps.com

Voice amplifier:

www.harriscomm.com/equipment/speech-assistance.html

Wheelchair ramp:

www.usarampstore.com/ez-access-multi-fold-ramp-5-to-10-feet/

Section 3 Resources

Accessible Van:

www.braunability.com/side-entry-wheelchair-vans/

Hoyer Deluxe Power Lift:

www.1800wheelchair.com/product/hoyer-deluxe-power-lift/

iPad:

www.apple.com

PCEYE Mini:

www.tobiidynavox.com/pceye-mini/

Power Wheelchair:

www.sunrisemedical.com.au/wheelchairs/quickie/power-wheelchairs/qm710-power-wheelchair

Proloquo2Go:

[Apple App Store](#)

Pull Down Cabinets:

freedomliftsystems.com/Wheelchair-Accessible-Kitchen/830-VERTI-15-39INCH

QuadStick Game Controller Adaptor:

www.quadstick.com/shop/cronusmax

QuadStick Game Controller:

www.quadstick.com/

Residential Elevator:

www.residentialelevators.com/index.htm

Tablet Holder:

www.wrightstuff.biz/tab-grabber-tablet-holder.html

Tablet Holder table clamp:

www.wrightstuff.biz/tab-grabber-table-clamp.html

Tolbii Dynavox Eyemobile Mini:

www.tobiidynavox.com/eyemobile-mini/

Tobii Dynavox I-Series:

www.tobiidynavox.com/iseriestplus/

References

Key Terms

Cook, A., & Polgar, J. (2015). *Assistive Technologies Principles & Practices* (4th ed.). St. Louis, MO: ELSEVIER.

Wijesekera, L. C., & Leigh, P. N. (2009). Amyotrophic lateral sclerosis. *Orphanet Journal of Rare Diseases*, 4, 3.
<http://doi.org/10.1186/1750-1172-4-3>

EHP Intervention Strategies

American Occupational Therapy Association. (2014). Occupational therapy practice framework: Domain and process (3rd ed.). *American Journal of Occupational Therapy*, 68(Suppl.1), S1–S48.
<http://dx.doi.org/10.5014/ajot.2014.682006>

Dunn, W., Brown, C., & McGuign, A. (1994) The Ecology of Human Performance: A Framework for Considering the Effect of Context. *The American Journal of Occupational Therapy*, 48 (7), 595-607. doi: 10.5014/ajot.48.7.595

Dunn, W., Brown, C., & Youngstrom, M. J. (2003). Ecological Model of Occupation. In P. Kramer, J. Hinojosa, & C.B. Royeen (Eds.), *Perspectives in Human Occupation, Participation in Life* (222-263). Baltimore, MA: Lippincott Williams & Wilkins

Fact Sheet

- Arbesman, M., & Sheard, K. (2014). Systematic review of the effectiveness of occupational therapy–related interventions for people with amyotrophic lateral sclerosis. *American Journal of Occupational Therapy*, 68, 20–26. <http://dx.doi.org/10.5014/ajot.2014.008649>
- Fried-Oken, M., Fox, L., Marie, R., Tullman, J., Baker, G., Mary, H., Wile, N., Lou, J.(2006). Purposes of AAC device use for persons with ALS as reported by caregivers. *Augmentative and Alternative Communication*, 22 (3), 209-221. doi: 10.1080/07434610600650276
- Kiernan, M., Vucic, S., Cheah, B., Turner, M., Eisen, A., Hardiman, O., Burrell, J., Zoing, M. (2011). Amyotrophic lateral sclerosis. *Lancet*, 377, 942-955. doi:10.1016/S0140-6736(10)61156-7
- Schettini, F., Riccio, A., Simione, L., Liberati, G., Caruso, M., Frasca, V., ... Cincotti, F. (2015). Assistive device with conventional, alternative, and brain-computer interface inputs to enhance interaction with the environment for people with amyotrophic lateral sclerosis: a feasibility and usability study. *Archives of Physical Medicine and Rehabilitation*, 96, 46-53. Doi.org /10.1016/j.apmr.2014.05.027
- Wijesekera, L. C., & Leigh, P. N. (2009). Amyotrophic lateral sclerosis. *Orphanet Journal of Rare Diseases*, 4, 3. <http://doi.org/10.1186/1750-1172-4-3>

CHAPTER V

SUMMARY

The *Assistive Technology to Enhance Occupations during Stages of ALS* manual was created to assist occupational therapists and caregivers in selecting appropriate assistive technology for patients with ALS as they progress through the disease. The manual covered the occupational areas of communication, mobility, home modification, and leisure. The purpose of the manual was to extend the performance range of an ALS patient in these areas as they progress through the disease.

This product includes limitations with consequent recommendations for future development. A limited amount of research was found on the use of assistive technology for ALS patients concerning communication, mobility, and leisure. It is recommended that additional research be conducted on these areas to indicate efficacy of assistive devices with the ALS population. The product was limited in the number of devices it presents. There are only thirty-six devices presented in this product. There are countless other devices available to an individual with ALS that they may find more useful or easier to use. Therapists and caregivers are encouraged to research additional devices for their patients/loved ones, if the devices presented are not financially feasible, difficult to obtain, or not easy to operate. This manual included a list of assistive technology resources where therapists and caregivers alike can search for assistive technology that best fits their needs.

This manual was created to be implemented within an inpatient, outpatient, or community setting. Additionally this manual can be shared with individuals with ALS and their families for use in the home setting. Users of this manual are provided with low and high technology options to assist in the areas of communication, mobility, home modification, and leisure. To ensure availability to a client, a family/caregiver of an ALS patient, or an OT, this manual can be posted on the internet. Providing a hard copy or a PDF copy to a facility will also allow occupational therapists access to the manual and will give the OT the opportunity to share it with a client or their family/caregiver.

Placing the manual on an appropriate site with permission of the domain owner and getting the manual to a variety of sites is a challenge with implementation of this manual. The authors expect that if the manual is found to be valuable at a site, the occupational therapists at that site may be willing to share it with other sites within their organization. The authors understand that even if the manual is found to be valuable at a site, redistribution may not take place.

There are several options for further development of this product. This product focused on communication, mobility, leisure, and home modification, as an individual progresses through the stages of ALS. Further development of this product could focus on just one of these areas. For example, there are several different options that are available for an ALS patient with communication deficits. The current manual does not cover every device, and a future product could be more inclusive of the types and variety of the communication devices that are available for an ALS patient. Another possible future development for this type of product is to create a database that would be user friendly and easily accessible to the public. A database could be created that asked the user to input occupational deficits, symptoms, and leisure interests. Once

that information is provided the database would show the user possible AT that would be beneficial to the patient. It could also provide the user with the name of a professional or facility that could train an individual or family/caregiver on proper use of the device, especially if the device is related to mobility.

REFERENCES

- Abrahams, S., Goldstein, L., Al-Chalabi, A., Pickering, A., Morris, R., Passingham, R.,...
Leight, P. (1997). Relation between cognitive dysfunction and pseudobulbar palsy in
amyotrophic lateral sclerosis. *Journal of Neurology, Neurosurgery, and Psychiatry*, 62,
464-472.
- American Occupational Therapy Association. (2014). Occupational therapy practice framework:
Domain and process (3rd ed.). *American Journal of Occupational Therapy*, 68(Suppl.1),
S1–S48. <http://dx.doi.org/10.5014/ajot.2014.682006>
- Arbesman, M., & Sheard, K. (2014). Systematic review of the effectiveness of occupational
therapy–related interventions for people with amyotrophic lateral sclerosis. *American
Journal of Occupational Therapy*, 68, 20–26.
- Ball, L., Anderson, E., Bilyeu, D., & Pattee, G. (2007). Duration of AAC technology use by
persons with ALS. *Journal of Medical Speech-Language Pathology*, 15(4), 371-381.
- Blacker, D., Broadhurst, L., & Teixeira, L. (2008). The role of Occupational Therapy in leisure
adaptation with complex neurological disability: A discussion using two case study
examples. *NeuroRehabilitation*, 23, 313-319.

- Bromberg, M. B., Brownell, A. A., ForsheW, D. A., & Swenson, M. (2010). A timeline for predicting durable medical equipment needs and interventions for amyotrophic lateral sclerosis patients. *Amyotrophic Lateral Sclerosis*, 11(1-2), 110-115.
doi:10.3109/17482960902835970
- Brown, C.E. (2009). Ecological Models in Occupational Therapy. In B. A. B. Schell, G. Gillen, M. E. Scaffa , & E. S. Cohn (Eds.), *Willard & Spackman's occupational therapy* (12th ed., pp. 494-504). Philadelphia: Wolters Kluwer|Lippincott Williams & Wilkins.
- Brownlee, A., & Bruening, L. M. (2012, April). Methods of Communication at End of Life for the Person with Amyotrophic Lateral Sclerosis. *Topics in Language Disorders*, 32(2), 168-185. doi:10.1097/TLD.0b013e31825616ef
- Cahill, M., Connolly, D., Stapleton, T. (2010) Exploring occupational adaptation through the lives of women with multiple sclerosis. *British Journal of Occupational Therapy*, 73(3), 106-115. doi: 10.4276/030802210X12682330090415
- Cook, A., & Polgar, J. (2015). *Assistive Technologies Principles & Practices* (4th ed.). St. Louis, MO: ELSEVIER.
- Dunn, W., Brown, C., & McGuign, A. (1994) The Ecology of Human Performance: A Framework for Considering the Effect of Context. *The American Journal of Occupational Therapy*, 48 (7), 595-607. doi: 10.5014/ajot.48.7.595
- Dunn, W., Brown, C., & Youngstrom, M. J. (2003). Ecological Model of Occupation. In P. Kramer, J. Hinojosa, & C.B. Royeen (Eds.), *Perspectives in Human Occupation, Participation in Life* (222-263). Baltimore, MA: Lippincott Williams & Wilkins

- Francis, K., Bach, J. R., & DeLisa, J. A. (1999). Evaluation and Rehabilitation of Patients with Adult Motor Neuron Disease. *Archive of Physical Medicine Rehabilitation*, 80(12), 951-963. Retrieved April 11, 2016.
- Fried-Oken, M., Fox, L., Marie, R., Tullman, J., Baker, G., Mary, H., Wile, N., Lou, J.(2006). Purposes of AAC device use for persons with ALS as reported by caregivers. *Augmentative and Alternative Communication*, 22 (3), 209-221. doi: 10.1080/07434610600650276.
- Gruis, K. L., Wren, P. A., & Huggins, J. E. (2011, May). Amyotrophic Lateral Sclerosis Patients' Self-Reported Satisfaction with Assistive Technology. *Muscle & Nerve*, 43(5), 643-647. doi:10.1002/mus.21951
- Kiernan, M., Vucic, S., Cheah, B., Turner, M., Eisen, A., Hardiman, O., Burrell, J., Zoing, M. (2011). Amyotrophic lateral sclerosis. *Lancet*, 377, 942-955. doi:10.1016/S0140-6736(10)61156-7
- Lancioni, G. E., Simone, I. L., Caro, M. F., Singh, N. N., O'Reilly, M. F., Sigafos, J., . . . Zonno, N. (2015). Assisting persons with advanced amyotrophic lateral sclerosis in their leisure engagement and communication needs with a basic technology-aided program. *NeuroRehabilitation*, 36(3), 355-365. doi:10.3233/nre-151224
- Lewis, M., & Rushanan, S. (2007). The role of physical therapy and occupational therapy in the treatment of Amyotrophic Lateral Sclerosis. *NeuroRehabilitation*, 22(6), 451-461.
- Nijboer, F., Sellers, E., Mellinger, J., Jordan, M., Matuz, T., Furdea, A., . . . Kubler, A. (2008). A P300-based brain-computer interface for people with amyotrophic lateral sclerosis. *Clinical Neurophysiology*, 119(8), 1909-1916. doi:10.1016/j.clinph.2008.03.034

- Rolfe, J. (2012). Planning wheelchair service provision in motor neurone disease: implications for service delivery and commissioning. *British Journal of Occupational Therapy*, 75(5), 217-222.
- Schettini, F., Riccio, A., Simione, L., Liberati, G., Caruso, M., Frasca, V., Calabrese, B., ... Cincotti, F. (2015). Assistive device with conventional, alternative, and brain-computer interface inputs to enhance interaction with the environment for people with amyotrophic lateral sclerosis: a feasibility and usability study. *Archives of Physical Medicine and Rehabilitation*, 96, 46-53. doi.org /10.1016/j.apmr.2014.05.027
- Servilio, K. L., & Mazzone, T. (2012, October). App Promotes Communications. *Exceptional Parent*, 42(10), 6-7.
- Spataro, R., Ciriaco, M., Manno, C., Bella, V. (2013). The eye-tracking computer device for communication in amyotrophic lateral sclerosis. *Acta Neurologica Scandinavica*, 1-6. doi: 10.1111/ane.12214
- Trail, M., Nelson, N., Van, J., Appel, S., Lai, E. (2001). Wheelchair use by patients with amyotrophic lateral sclerosis: a survey of user characteristics and selection preferences. *The American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation*. 82, 98-102. doi:10.1053/apmr.2001.18062
- Turpin, M., Iwama, M. K. (2011) Using occupational therapy models in practice: a field guide Edinburgh; Churchill Livingstone/Elsevier.
- Ward, A.L., Hammond, S., Holsten, S., Bravver, E., & Brooks, B.R. (2015) Power Wheelchair Use in Persons With Amyotrophic Lateral Sclerosis: Changes Over Time. *Assistive Technology*, 27:4,238-245, doi: 10.1080/10400435.2015.1040896

Ward, A. L., Sanjak, M., Bravver, E., Williams, N., Nichols, M., & Brooks, B. R. (2010, February). Power Wheelchair Prescription, Utilization, Satisfaction, and Cost for Patients With Amyotrophic Lateral Sclerosis: Preliminary Data for Evidence-Based Guidelines. *Archives of Physical Medicine and Rehabilitation*, 91(2), 268-272.
doi:10.1016/j.apmr.2009.10.023.

Wijesekera, L. C., & Leigh, P. N. (2009). Amyotrophic lateral sclerosis. *Orphanet Journal of Rare Diseases*, 4, 3. <http://doi.org/10.1186/1750-1172-4-3>