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Assistive Technology Provision by Occupational Therapists: A Process and Tools for Managing

Clients with Spinal Cord Injury

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Abstract

Occupational therapy focuses on complex dynamic relationships between people, occupations and environments. For clients with spinal cord injuries (SCI), a way of improving the connection between these three aspects is by providing assistive technology (AT). A fundamental issue identified by consumers regarding AT provision was abandonment, which is caused by a mismatch between aspects of the person, the assistive product, and characteristics of the environment. One solution is engaging collaboratively with clients and recognizing individual needs, thereby allowing therapists to meet clients' occupational expectations and provide clients with increased functional independence. During this capstone project, barriers to AT provision were identified through an extensive review of the literature, an online survey sent to 82 therapists, and a 90-hour residency with AT specialists. Respondents reported a need for further education on AT, that confidence with high-tech AT was lower than with low-tech AT, and a need for a simplified AT resource tool. This resulted in creation of an educational resource AT tool, in website format, called the Assistive Technology Prescription Tool for Occupational therapists (ATPT-OT). The ATPT-OT is a tool designed to enhance occupational therapists' ability to identify and recommend AT for individuals with SCI during the prescription process.

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Assistive Technology Provision Process and Tools for Managing Spinal Cord Injury Clients

Background and Significance

Spinal cord injury (SCI) results from direct damage to the spinal cord, or indirectly to the vertebral column resulting in increased muscle spasticity, possible loss of normal bowel and bladder control, loss of sensation, muscle weakness, and paralysis (Porth, 2010). The main causes of SCI include trauma (i.e. car accidents, gunshot wounds, and falls) and disease (i.e. transverse myelitis and polio). Spinal cord injury is categorized as either primary or secondary (Porth, 2010). The primary neurologic injury occurs at the time of injury and the secondary occurs after the initial injury through edema, spinal shock, vasoactive agents, or cellular enzymes (Porth, 2010). This injury can affect several areas of function, such as activities of daily living (ADL), instrumental activities of daily living (IADL), leisure pursuits, and functional mobility, and can result in occupational deficits and depression (Pendleton & Schultz-Krohn, 2012). The person's neurological level of impairment (tetraplegia/paraplegia) and degree of impairment (complete or incomplete) are directly related to the level of physical assistance required, which at times may result in requiring technology (Pendleton & Schultz-Krohn, 2012).

Definition of assistive technology. Assistive Technology is defined as "any item, piece of equipment, or system, whether acquired commercially, modified or customized, that is commonly used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Assistive Technology Act of 2004, 2004). Assistive Technology devices range from simply designed low-tech equipment to complicated high-tech equipment. High-tech devices integrate the use of electronics or computers, such as speech recognition software, digital hearing aids, talking calculators, iPhones, and iPads; in contrast, low-tech devices are less costly, do not require computer or electronics to operate, and are easier to obtain. Examples of low-tech

devices are highlighting pens, grab rails, adapted eating utensils, pencil grips, splints, and picture sequence board (Ahmed, 2010).

Positive attributes of Assistive Technology

With assistive technology, a person can achieve a higher level of independence in tasks such as answering phones, adjusting their bed height, controlling computers, lights, and televisions (McKinley, 2013). The positive attributes of assistive technology can be measured by its impact on the occupational performance and quality of life of the person with disabilities (Table 1).

Table 1

Examples of how assistive technology can be beneficial

- It can help persons with disability to perform functions that would otherwise have been difficult, such as using speech recognition devices to communicate effectively.

- It can assist with functional mobility (power wheelchair) with wireless control interface.

- It can aid disabled persons to participate in normal programs or activities without assistance.

- It can support persons with memory deficits in the performance of routine tasks by using a picture sequence board.

- It can improve concentration on learning or working tasks with the aid of AT programs.

- It facilitates social interaction and social inclusion by allowing disabled people to access the Internet.

- It facilitates access to education with the help of virtual learning software that allows a person to study at home.

- Assistive technology can improve independence and autonomy and helps to provide safer

and functional living environments for clients.

Note. From Goodman, N., Jette, A., Houlihan, B., & Williams, S. (2008). Computer and internet

use by persons after traumatic spinal cord injury. *Archives of Physical Medicine and*

Rehabilitation, 89(8), 1492-1498.

According to Scherer and Glueckauf (2005), assistive technology can also benefit service

providers in several ways, including the satisfaction that comes from achieving better quality of

life outcomes for their clients while reducing care and staffing costs. Appropriate AT increases

client independence and improves their chances of reintegration back into the community.

Limitations of assistive technology provision. While assistive technology offers many

benefits, the literature identifies a number of barriers to those who use and those who prescribe

assistive technology. The barriers reported by consumers of assistive technology include having

limited access to devices combined with the complexity of device features. Another barrier

reported by consumers relates to poor assistive technology design and poor setup of the assistive

technology unit within the consumer's chosen environment, as well as a lack of client training

(Collinger et al., 2013). Limited knowledge about financial resources and service options by

consumers and therapists, social barriers, and the reported frequent breakdown of technology

were identified as other issues impacting the provision, procurement, and use of assistive

technology by clients (Bernd et al., 2009; Collinger et al., 2013; National Council on Disability

2000; Scherer, 2010; Wielandt, Mckenna, Tooth, & Strong, 2006). The failure of clinicians to

account for varying learning styles among clients is another identified barrier to clients' learning

and comfort in using the assistive technology equipment that is provided (Cook, Hussey, &

Polgar, 2008; Coupley & Ziviani, 2004).

An additional limitation for assistive technology provision is the procurement process: assistive technology requires a medical professional (i.e. occupational therapist, assistive technology practitioner, rehabilitation engineers, vendor, or funder) to provide a justification that a physical deficit is present and that a medical necessity exists that justifies the need for equipment, to be paid for privately or through medical insurance. Furthermore, the medical model drives many of the federally mandated sources for assistive technology acquisition (i.e., Medicaid, Medicare, and private insurance providers). "It operates on the assumption that the person with a disability needs assistance for a particular area of impairment, rather than viewing the individual as a whole person seeking participation in everyday activities" (Gentry & Wallace, 2011, p. 297). These barriers can be attributed to the issues of accessibility and limited knowledge of available resources by therapists, both of which are needed to facilitate effective provision of assistive technology services and usability of assistive technology devices (ARC of the United States, 2011; Bernd et al., 2009; Collinger et al., 2013; National Council on Disability 2000; Scherer, 2010; Wielandt, Mckenna, Tooth, & Strong, 2006). These listed barriers attribute to the non-use or abandonment, which occurs when a mismatch exists between aspects of the person, the assistive device, and the environment.

Current models in provision process. The literature within rehabilitation is rich with frameworks and models that can be used during the selection of assistive technology, with each one focusing on an ecological and multidisciplinary collaborative approach (Bauer, Elsaesser, Scherer, Sax, and Arthanat, 2014; Cook and Polgar, 2008; Institute for Matching Person and Technology, 1999; Zabala, 1998). Examples of these models include: the Student, Environments, Tasks, and Tools framework (SETT) and the Human Activity Assistive Technology Model (HAAT), which are primarily designed for assistive technology assessment

within school settings; the Matching Person and Technology Model (MPT) targets adults with

disabilities and the Assistive Technology Service Method (ATSM), which focuses on assisting

clinicians with provision of evidence-based and interdisciplinary AT services. None of the

models mentioned above were specifically tailored for the SCI population, but they might be

able to lessen abandonment issues. The models mentioned above will be further explored in the

literature review section of this paper.

      Role of occupational therapy. Occupational therapists (OTs) help people, "engage in

everyday activities or occupations that they want and need to do in a manner that supports health

and participation" (AOTA, 2008, p. 626). People with SCI living in the community often need

assistance with occupations such as ADL and IADL, assistive technology and home

modifications (Hammel et al., 2002). Occupational therapists are the leading professionals in the

inpatient rehabilitation setting who prescribe AT (Rigby, Ryan, & Campbell, 2011; Steggles,

2005). "OT services directly assist individuals with disabilities in the selection, acquisition and

use of an assistive technology device" (Mann & Lane, 1995). OTs are uniquely qualified to

address technology interventions due to their innovation, flexibility, creativity, and holistic

(physical and emotional components, client's roles, and environment) approach (Lange, 1997;

McKenna & Mellson, 2013). Most often, professionals view the primary role of assistive

technology as restoring functional independence to individuals with disabilities. They tend to

see their role as assessing the individual for assistive technology needs and preferences, ordering

and training individuals on assistive technology use, and adapting assistive technology (Scherer,

2010).

      The importance of occupational therapy practitioners having the skills to assess and

recommend assistive technology equipment for clients emerged as a critical theme in the

literature (Emerich, Parsons, & Stein, 2012; Hammond et al., 2013). In the absence of these

skills, occupational therapy practitioners, are not able to effectively play their role within the AT

provision process. Specifically, it is crucial that therapists in rehabilitation settings have

knowledge of existing products on the market and potential modifications so that they may in

turn better assist clients to achieve successful outcomes with the equipment (Hreha & Snowdon,

2011; Emerich et al., 2012). It is also important that OTs incorporate theories and models that

guide their practice in the provision of technological accommodation to client environments

(Elsaesser and Bauer, 2011). It is also important to note that the American Occupational

Therapy Association (AOTA), which is the national association for occupational therapy, echoes

the importance of technology in its 2017 Centennial Vision. The Centennial Vision identified

technology and assistive-device development and consulting as an emerging area in occupational

therapy.

Since the recommendation of AT for clients should be guided by models that enable the

OT to select appropriate technology for clients, it is important for the OT to understand which

theoretical model is the best fit for specific clients. According to the Matching Person

Technology Model (Scherer, 2005; Wielandt, McKenna, Tooth, and Strong, 2006), when

assistive technology services are carried out according to the client's predispositions,

preferences, experiences, and skills, the use of an assistive technology device will more likely

match his or her occupational expectations and needs. Several well-established theoretical

frameworks/models have been developed such as the MPT, HAAT, ATSM and SETT to guide

systematic provision of assistive technology services (Bauer et al. 2014; Cook & Polgar, 2008;

Scherer, 2005); however, there are no best practices, guidelines, or clear consensus, on how

assistive technology service models can be implemented specifically for the SCI community.

The lack of standardized guidelines for AT provision is further complicated by the fact that the

prescription process is not approached uniformly by AT providers, with differing values and

priorities of professionals affecting the decision-making and assessment process (Parette, 1995).

The lack of a standardized assistive technology service method has led to a "fragmented AT

service system" (Elsaesser & Bauer, 2011, pp. 386) with ineffective communication among

providers, manufacturers, and clients, resulting in inefficient resource allocation and suboptimal

outcomes for AT recipients (Elsaesser & Bauer, 2011). By providing a structured process

involving the clients input and by following the Accreditation Council for Occupational Therapy

Education (ACOTE) guidelines (B.5.10), some of these issues that lead to abandonment may be

ameliorated.

Purpose and Objectives

Assistive technology is a vital component to the rehabilitation of clients with spinal cord

injuries. Appropriate assistive technology prescription is essential to enhance occupational

independence of the client with spinal cord injuries. Adequate training of occupational therapists

on prescription processes, access to the tools to achieve this, and utilization of the model that

matches clients' needs and the environment will decrease abandonment and achieve the desired

outcome. This capstone project aimed to identify challenges faced by therapists who provide

assistive technology for clients with spinal cord injuries and provided an opportunity to identify a

solution to a known problem. This solution enhances occupational therapists' ability to identify

and recommend assistive technology during prescription to promote occupational performance

and participation for people with spinal cord injuries. Steps taken during this project included

initial review of the literature, residency experiences with expert assistive technology specialists,

creation of a survey, interpretation of survey responses, contemplation of a variety of solutions,

and subsequent creation of a resource tool. The objectives of this capstone project were to:

- ascertain whether therapists feel prepared through school and training modules to provide information and make recommendations about AT to clients;

- understand the current process of AT prescription better;

- identify problems or challenges as identified by therapist who provide AT;

- identify reasons for AT abandonment by consumers;

- identify and describe occupational therapy AT prescription procedures that AT specialists use;

- identify current AT assessment tools suitable for use by OTs;

- identify models used for AT provision, and those that could be applied by OTs working with persons with SCI;

- identify resources OTs can use when educating clients with SCI;

- develop a solution for OTs that helps with AT prescription for clients with SCI.

Chapter 2: Literature Review

This chapter provides an overview of available literature and presents major ideas that emerged from the reviewed literature related to AT and its use for people with various disabilities. The articles reviewed reflect use of AT in various contexts for varied client populations, explore current AT and OT models, identify issues or barriers to AT procurement and use, review the current process of acquiring AT, and explain AT provider training during prescription.

Models of AT Provision

From the literature, three AT conceptual frameworks/models were identified that are used for AT prescription: Student, Environments, Tasks, and Tools framework (**SETT**); the Assistive Technology Service Method (**ATSM**); and the Human Activity Assistive Technology Model (**HAAT**). The Student, Environments, Tasks, and Tools framework (SETT), designed for use with students with disabilities from zero to 15 years old serves as a "guideline for gathering data in order to make effective assistive technology decisions" (Zabala, 1998, p. 2). The framework identifies three areas of consideration (i.e., student, environment, and tasks) and encourages a user to investigate which tools to use to meet a student's needs. Within SETT, a series of questions are asked to the student about his/her abilities and needs, his/her physical environments, activities the student is asked to perform combined with barriers to performance, and available AT devices and services. The intended outcome of SETT is to discover a match among the student, environment, tasks, and technology used to accomplish the tasks within the environment.

The second model is the Assistive Technology Service Method (ATSM) by Bauer et al. (2014), which provides a framework based on the International Classification of Functioning,

Disability and Health (ICF) standards, models, and guidelines with identification of individual

and societal outcomes. The Assistive Technology Service Method supports provision of client-

centered, evidence-based, and interdisciplinary AT services. The framework was developed to

meet the need for efficient service delivery and facilitate effective coordination between services,

systems, and policies supporting the provision of AT. Bauer et al. (2014) determined that the

ATSM could improve communication between stakeholders, service delivery consistency,

resource allocation and intervention outcomes.

The third model is the Human Activity Assistive Technology Model (HAAT), which also

explores inter-relationships between the individual, activity, and AT in a context. The Cook and

Polgar (2008) model, considers an individual's skill level, the activity that the individual is

expected to perform (e.g., self-care, work/school, and play/leisure), and the context in which the

activity occurs (social, cultural, and physical). In addition to SETT, ATSM and HAAT, the

Matching Person and Technology Model (MPT) appears frequently in the literature, and the

author found it most relevant to this capstone. The Matching Person and Technology Model is a

holistic, client-centered model that considers users' expectations, preferences, backgrounds,

family and environmental influences, and economic factors during determination of AT (Institute

for Matching Person and Technology, 1999). Three components comprise the MPT (i.e., milieu,

person, and technology), assessed using a series of questionnaires. Milieu focuses on

characteristics of the settings in which the AT is to be used. The person component provides

information about a user's personal characteristics and temperament. The technology component

focuses on characteristics of the technology, including design factors and funding (Scherer,

2005). Within MPT, a tool exists that is unique to the SCI population—the Assistive

Technology Device Predisposition Assessments (ATDPA)—that assesses perceived quality of

life through consumer participation in developing and setting AT goals, and by helping a

consumer to understand his/her needs and interests better while identifying obstacles to AT use

(Scherer & Cushman, 2001). It has demonstrated good interrater reliability, internal consistency,

criterion-related validity, concurrent and construct validities, and predictive validity (Scherer &

Cushman, 2001; Scherer, Sax, Vanbiervliet, Cushman, & Scherer, 2005). The Matching Person

and Technology Model is unique in that it assesses a client's expectations and preferences,

unlike the other two conceptual frameworks/models. These three frameworks/models should be

used in conjunction with an OT frame of reference to guide occupational therapists during AT

selection for SCI clients.

Occupational Therapy Frames of References

Two occupational therapy frames of references (FOR) were identified by the author that

could work in conjunction with the AT models to facilitate selection and distribution of AT by

OTs for SCI clients. The first is the Model of Human Occupation (MOHO), which regards

human occupations as complex and influenced by a person's volition, habituation, aspects of

performance, and the environment (Kielhofner, 2009). Volition refers to a "person's motivation,

interests, values, and belief in skill" (Kielhofner, 2009, p. 170). Habituation means a person's

roles in life, with rules/expectations, patterns of behavior, and routines. Performance includes

motor, cognitive, and emotional skills gained from physical attributes and life experiences

necessary to act within an environment. A person's environment, which includes the physical,

social, and societal influences, affects occupation. The MOHO is a client-centered, holistic

model that focuses on the idea that through participation in occupations, humans can increase

adaptive responses. Prescribing AT from a holistic, client-centered model such as the MOHO, a

therapist can ensure that recommended AT meets the specific needs of the client thereby

reducing the risk of abandonment.

The other frame of reference explored was the Person Environment Occupation Model

(PEOM). The PEOM provides a structure to guide OTs' clinical reasoning when analyzing and

understanding the interdependent interaction between a person, occupation, and environment

(Law et al, 1996). The person is the most important aspect in the model, including motivations

for activities, the way they respond emotionally to situations, and degree of independence. Law

et al. (1996) defines the environment as "the context within which occupational performance

takes place and it is categorized into cultural, socioeconomic, institutional, physical and social"

(p.16). The environment contains both demands and cues regarding behavior expected from a

person and from the person's perspective. Occupation in PEOM is defined as "self-directed

meaningful tasks and activities engaged in throughout a lifespan" (Law et al, 1996, p16). The

model identifies the areas of occupation as self-care, productivity and leisure. Occupations are

analyzed as tasks, with a focus on their characteristics, amount of structure, complexity, task

demands, and task duration. A benefit of the PEOM is it offers a foundation for guiding

assessment and intervention across all practice settings and client populations. Furthermore, it

enables therapists to consider the complexities of human functioning and experience in the day-

to-day realities of clients' lives and therapists' practices; thus promoting client centered decisions

regarding potential assistive device prescription for clients with SCI.

Issues associated with Assistive Technology Provision

Abandonment. Abandonment has emerged as a suboptimal outcome because of poorly

structured assistive technology provision. According to Scherer (2002) abandonment rates range

from 30% to 59%. Reasons for AT abandonment can be classified into three categories:

characteristics of the person (user-related), characteristics of the assistive product (device-related) and characteristics of milieu or environmental factors (Scherer, 2010; Arc of the United States, 2011). The non-use of assistive equipment can lead to decreased occupational performance, safety risks, and loss of independence and client dissatisfaction. The failure to account for consumers' input, their personal and environmental factors, lack of training, unfamiliarity with setup, and lack of follow-up services are indicated to be the prime contributing factors for abandonment (Arthanat, Simmons, & Favreau, 2012; Brandt et al., 2011; Emerich et al., 2012; Waldron & Layton, 2008). The literature supports the idea that when assistive technology is appropriately selected with client input, client satisfaction is improved and client abandonment is decreased (Scherer, 2010).

Although professional and accreditation standards for occupational therapy programs mandate and support the consideration and application of assistive technology education and training, it is not known if practitioners in the field have the knowledge and skills required to successfully assess and recommend assistive technology as intended. The above-mentioned factors that contribute to abandonment may be ameliorated if healthcare professionals provide adequate information and guidance to clients regarding recommended assistive technology, which this project aimed to address.

Ethics and assistive technology. A topic that emerged in the literature was ethics or ethical considerations in relation to provision of AT (Greenfield & Musolino, 2012). According to several authors, use of AT during rehabilitation has grown rapidly, and many practitioners in the rehabilitation field are concerned that use has outpaced applicable ethical considerations related to contemporary use. Ethical use of technology includes equality of access, which explores variations and inequalities in AT deployment (Greenfield & Musolino, 2012).

Additionally, national organizations and governmental agencies have begun to support ethical

use of AT by exploring various elements of AT access and use and creation of policies

(Greenfield & Musolino, 2012). One such organization is the American Occupational Therapy

Association, which has created ethical standards for professional and ethical responsibility for

OTs. Principle 5 of the Occupational Therapy Code of Ethics and Ethics Standards states that

practitioners are responsible for "maintaining high standards and continuing competence in

practice, education, and research by participating in professional development and educational

activities to improve and update knowledge and skills" (AOTA, 2010, p. S23). The principle

ensures that practitioners remain informed of current knowledge and are able to apply it

effectively to address clients' needs. These ethical considerations are relevant not only in

educational settings, but also in every setting OTs find themselves delivering AT services to

clients.

      Post-discharge assistive technology use. Outcomes realized from AT provision vary

across cases. AT is often used during rehabilitation interventions, and is meant to contribute to

favorable rehabilitation outcomes (Rust & Smith, 2005). It is important that the outcomes of

targeted AT interventions are tracked post discharge from inpatient facilities in terms of a

person's function, quality of life, and participation (Rust & Smith, 2005). Wielandt, Mckenna,

Tooth, and Strong (2006) studied the ability of three factors—AT, client, and intervention—to

predict post-discharge use of devices recommended by occupational therapists for bathing,

toileting, and dressing. The study identified seven variables that predict AT use, including the

presence or absence of user anxiety, equipment characteristics, and the ability of a client to recall

training. Four additional variables included negative perceptions about an illness/disability,

choice during AT selection, intended post-discharge use of AT, and perceived benefits of AT

(Wielandt et al., 2006). Based on the findings of two studies, a client-centered, team-based

approach of AT planning and implementation was suggested to support the development and

deployment necessary for AT application (Copley & Zivani, 2004; Wielandt et al., 2006).

Special attention should be given to clients' perceptions and opinions to ensure that AT

acceptance and use are supported best (Wielandt et al., 2006).

Issues with assistive technology training and education for health professionals. The

importance of AT provision in the context of various rehabilitation settings and niches has been

identified in the literature, but there is lack of training and education for healthcare workers to

capitalize on the opportunities made possible through AT (Marsters, 2011). Greenfield and

Musolino (2012) argue, "As educators prepare health care providers for the 21st century in the

United States, the time has come to re-examine implications of contemporary AT education for

therapy students" (p. 81). Long, Woolverton, Perry, and Thomas (2007) suggest that the training

providers receive when working with children who have a need for AT fails to keep pace with

related developments; as new and more sophisticated AT options become available. They are

not deployed effectively due to lack of related training and knowledge by therapists. This might

be attributed to the fact that evidence-based knowledge concerning AT selection is limited, and

few models and instruments exist in scientific literature regarding theoretical foundations of AT

selection and advisory procedures (Bernd, Van Der Pijl, & De Witte, 2009). This leads to use of

non-uniform approaches to AT prescription, with competing values and priorities of

professionals becoming evident during decision-making and assessments (Parette, 1995).

Brady, Long, Richards, & Vallin (2007) suggest that gaps exist in AT training and

education for OTs and although most practitioners receive some AT training while in graduate

school, their confidence levels when performing evaluations, and selecting and operating

appropriate AT devices are low. In addition, most OTs complete their education with a narrow scope of knowledge about AT services (Brady, Long, Richards, & Vallin, 2007). Kanny and Anson (1998) examined the prevalence of AT-related training with occupational therapy students between 1989 and 1994/1995, finding that AT education and use increased significantly during that period within the context of 11 areas. The most significant increases were in terms of environmental access and robotics, sensory aids, augmentative communication, and orthotics and prosthetics. The upward trend in training provided to OT students might have been due to growth in the use of related technologies. Lahm and Sizemore (2002) suggest that schools should increase efforts to educate students on beginning AT concepts and awareness to prepare professionals for the future. AOTA has taken steps to achieve this, evidenced in the ACOTE standard, B.5.10, which states that entry-level occupational therapists should be able to "articulate principles of and be able to design, fabricate, apply, fit, and train in assistive technologies and devices (e.g., electronic aids to daily living, seating and positioning systems) used to enhance occupational performance and foster participation and well-being" (AOTA, 2013, p. 24). Although the ACOTE standards promote uniformity in AT education, it remains unclear whether OT students and therapists implement these standards in practice.

In addition to the education and training challenges mentioned above, limited use of AT interventions in mental health settings has been attributed to a lack of AT training for OTs. Gitlow et al. (2009) explore use of AT in relation to occupational therapists working in mental health settings. Through assessment of related literature, they found that OTs working in a mental health context generally use no-to-low tech AT interventions, despite the fact that there are often high-tech AT solutions to assist individuals with mental illness who have co-existing cognitive disabilities. This has been attributed to lack of AT training for OTs in mental health.

They suggest that professional development programs should be developed and further research

should be conducted to support optimum use of AT in the mental health field by OTs (Gitlow et

al., 2009). Brady, Long, Richards, & Vallin (2007) suggest that AT education and training

should be expanded for entry-level OTs and PTs by increasing the number of hours dedicated to

AT, so they can support clients through accurate and adequate AT deployment.

Assistive technology in educational settings. Provision and use of AT offers value in

all levels of public education for students with disabilities. Brady et al. (2007) suggest that

children with special healthcare needs and multiple disabilities benefit from low to high tech AT

devices. AT provides special-needs children with improved access and participation in their

schools and home environments. The effectiveness of AT outcomes in education however

depends largely on collaborative and coordinated assessments and implementations (Carey &

Sale, 1994; Coupley & Zivani, 2004). Hemmingsson, Lidstrom, and Nygard (2009) examine use

and non-use of AT devices in schools by students with physical disabilities, finding that students

adopt both a psychosocial and cognitive perspective of their devices, thus both elements should

be supported during their training to ensure that the devices are used effectively. Despite the

benefits of AT, the realized value of AT in education for children with disabilities, as in mental

health, depends on effective assessments, selection, and proper implementation of recommended

AT.

Barriers to assistive technology use in educational settings. In childhood education,

AT has potential value in both home and school environments for children with disabilities, but

there exist many barriers to AT adoption that make integration of AT for the SCI population in

schools difficult. These barriers include negative staff attitudes, insufficient funding, time

constraints, inadequate assessments and planning, and lack of staff training and support (Carey &

Sale, 1994; Coupley & Ziviani, 2004; Craddock, 2006; Derer et al., 1996). Youths require both

hands-on training and verbal instruction to obtain the right perspective and competency when

using AT in schools (Hemmingsson et al., 2007). This underscores the importance of training

OTs and student recipients of AT, which is essential to support AT use.

Supporting Assistive Technology Deployment

One goal of AT provision for occupational therapists is to assist and guide clients by

identifying needs, educating on equipment options, assisting with identifying the most

appropriate options, training in use of AT, and helping with acquiring funding (Steggles, 2005).

According to Wilcock and Townsend (2000), to ensure occupational justice, considerations such

as occupational equity, occupational fairness, occupational empowerment, occupational rights

and responsibilities, and respect for personal and cultural influences during occupational

engagement must be addressed. Occupational therapists must be mindful of these considerations

during AT prescription to support ethical and professional responsibilities of providing AT to

clients. Several AT provision solutions have been presented in the literature to help OTs achieve

these goals toward promotion of occupational engagement. In recent years, federal legislation

such as the Individuals with Disabilities Education Act of 2004 and the AT Act 2004 have been

passed to support greater use of AT for people with disabilities, creating broad advocacy that

results in upward trends of the use and benefits of AT (Long & Perry, 2008). Marster (2011)

proposes a solution to address AT deployment; AT professionals working in school systems

should participate in pre-service training programs and share knowledge regarding AT among

themselves to increase operational knowledge tailored to the profession, which includes

functional, strategic, and social understanding of AT implementation. Another solution from

Pelosi and Nunes (2009) uses a mentoring training course in AT for healthcare professionals,

during which inexperienced healthcare professionals are paired with more experienced peers to help change the knowledge and attitudes of those with less experience toward AT use. Additionally, Bernd, Pijl, and Witte (2009) propose the addition of evidence-based procedures to improve AT providers' knowledge bases and increase consumer satisfaction with AT proficiency in all contexts.

Summary

The literature reflects use of AT in various contexts and populations and identifies current AT and OT frameworks/models that apply to AT provision by occupational therapists. In addition, the literature identifies abandonment as an unintended outcome of the AT provision process, reviews processes of acquiring AT, and explains AT provider training and education. Although occupational therapists are positioned to address some of these identified issues to AT provision, evidence from the literature regarding more effective practice guidelines for occupational therapists working with SCI clients is limited. For this capstone project, the doctoral student explored current barriers in the AT prescription process identified by occupational therapists working in an inpatient context. Utilizing the information gained from the MPT model and PEOM frames of reference, the student then developed an educational resource tool that incorporates the solutions found in the literature to help therapists during selection of AT devices for SCI clients.

Chapter 3: Capstone Process

This doctoral student examined barriers surrounding AT provision, as identified by

therapists working with a diverse client population. The capstone process that the student used

to explore the identified factors affecting assistive technology provision in occupational therapy

is discussed in this section. The capstone project began with a comprehensive literature review

to learn about current barriers associated with AT provision and was followed by residency with

AT specialists. Based on evidence gathered during those two activities, the doctoral student

designed a survey and had it administered online to primarily rehabilitation therapists (OT, PT,

COTA, SLP, a behavioral therapist, and an educator) to explore factors that might influence the

provision of AT services. Understanding that occupational therapy is not the only health

profession participating in AT service delivery, the doctoral student sought responses from other

professionals that work with individuals with disabilities and that might require AT devices.

However, it was the student's intention to highlight the impact of the survey results on the OT

profession specifically. Factors explored included AT education received by therapists,

therapists' confidence with AT, and challenges with AT provision. The project aimed to address

the following questions:

Aims of Capstone Project

1. Do therapists feel adequately prepared through school and continuing education courses
   to provide information and make recommendations confidently about AT to clients?

2. Will therapists identify a need for an educational tool to help with AT provision?

Capstone Design

Capstone residency. A 90-hour capstone residency was completed with AT specialists

in various settings. During residency, the author learned about AT fundamentals and consulted

with experts in AT provision to develop the survey. Knowledge gained from the literature

reviewed on various AT models was discussed purposefully with residency supervisors to get

their opinions and learn about their experience with AT provision. Specifically, during the

residency, the capstone student spent time with AT specialists at a RESNA course in Boston,

MA, at The Walter Reed National Military Medical Center (WRNMMC) in Bethesda, MA, at

The Assistive Technology Program in Washington D.C., and with an AT expert in his office in

Houston, TX. Most of the edification occurred through classroom-based learning, observation,

reading, and hands-on activities.

Assistive technology expert and RESNA course. The author first spent time with

Rafferty Laredo (OTR, ATP) discussing his experiences as a clinical coordinator with educating

and training OTs on AT concepts and ideas. Mr. Laredo also served as a content expert during

development of the resource tool that was created following analysis of survey responses. The

author also attended a RESNA course titled *Fundamentals Course in Assistive Technology* in

Boston, MA. The RESNA course solidified the knowledge gained by the author while attending

graduate school, while performing the literature review, and from the author's experience as an

occupational therapist working with AT.

Walter reed national military medical center. The greatest amount of time (45 hours)

was spent at WRNMMC with Mark Lindholm (OTR) and Amanda Reinsfelder, MS, assistive

technology specialists (ATS). While at WRNMMC, the author participated in AT evaluations of

clients and was involved in educating clients, procuring AT, and setting up recommended AT

equipment. The ATS at WRNMMC explained that they use the HAAT model and a mix of formal and informal evaluation methods to guide them during the AT selection process.

  The assistive technology program. Additional residency hours were spent at the Assistive Technology Program, a stand-alone center in Washington D.C., with Debra Haydel, ATP learning about AT provision, deficits in the system, and information on funding sources at state and national levels. Time spent at this location provided an opportunity for the author to obtain hands-on experience in demonstration labs with several forms of AT such as the eye-gaze system, modified computer mice and other input devices, and learning about infrared technology. During the residency, the author began the development of an online survey aimed at understanding current AT provision processes by OTs and gathered input from residency supervisors regarding proposed solutions for AT procurement.

  Survey and respondent selection. The author developed and disseminated a 23-question survey to a group of rehabilitation practitioners who prescribe AT and work in inpatient rehabilitation settings because the author was interested in discovering current methods and practices among AT providers. Survey invitations were sent to former therapist colleagues of the author, who worked in inpatient rehabilitation settings. These therapists were asked to forward the link to colleagues they knew through Facebook or e-mail. Eighty-two responses were received from therapy practitioners, of whom 56 were OT practitioners and 13 SCI OTs. The survey collected data from practitioners (e.g., physical therapists, occupational therapists, and speech language pathologists) regarding their perceived confidence with AT, barriers to AT provision, confirmation or denial concerning a need for an AT educational resource tool, and assessment of their willingness to trial a resource tool. The survey was created using Survey Monkey, which was ideal since it enabled quick administration and evaluation of results, and it

facilitated easy tabulation of results in a short time period. A sample survey was first emailed to

a group of five therapists for review and to offer feedback (Appendix A). Once their feedback

was received, it was integrated into a revised survey (Appendix B) and disseminated to therapists

through Facebook and e-mail. Each e-mail provided potential respondents with information that

detailed an overview of the survey, benefits of participation, and an invitation to contact the

author with questions. Surveys were to be returned within 30 days. Returned responses were

reviewed and used to guide the doctoral student's selection of a tool format and creation of the

ATPT-OT, which was developed with guidance from an AT content expert and tutelage from a

website designer.

Data collection and analysis. The survey was comprised of 23 items that used a 4- to 5-

point Likert-type scale, some Yes/No questions, and space for additional comments (Appendix

B). The survey included demographic questions and items that focused on participants'

confidence with AT provision, education, barriers to AT provision, current provisional

processes, and willingness to test and offer feedback on a tool developed at the completion of the

project. The survey was anonymous. When participants clicked on the link, the survey opened,

and when completed and submitted, the author had sole access to the data. Data from the survey

were generated through software from Survey Monkey and the data was analyzed using both

descriptive and inferential statistics. Analyses included exploration of therapists' education and

experiences with AT, confidence with prescribing ATs, and preferred methods of receiving and

using educational resource tools for OT practitioners. The results of the survey identified some

of the identified barriers with OT prescription of AT. One such issue was the lack of a

standardized assessment tool. This absence of an assessment tool led to the development of the

ATPT-OT resource tool.

Summary

Following the completion of the literature review, the author spent time in a capstone residency program with AT specialists, during which the author created a survey for therapy practitioners to gather information on issues and factors influencing AT provision. The survey was also used to assess therapists' confidence with AT prescription, barriers during AT provision, and preferred medium for educational tools. With this information, the author explored solutions to bridging gaps found in the literature, which resulted in the creation of the ATPT-OT, a resource tool with the goal of improving occupational therapists' ability to identify and provide AT to clients with SCI.

Chapter 4: Findings

Participant Information

Professions. Eighty-two responses were received from therapists of various disciplines.

Ninety percent were female, and 10% male; 70% were occupational therapist practitioners

(OTs), 23% physical therapists (PTs), and 7% other professions (speech language pathologists

(SLP), an educator, and a behavioral specialist) (Figure 1). Of the 82 respondents, 56 were OTs

and the remainder were from other professions (PT, SLP, an educator, and a behavioral

specialist). Of the 56 OTs, 13 worked primarily with SCI clients.
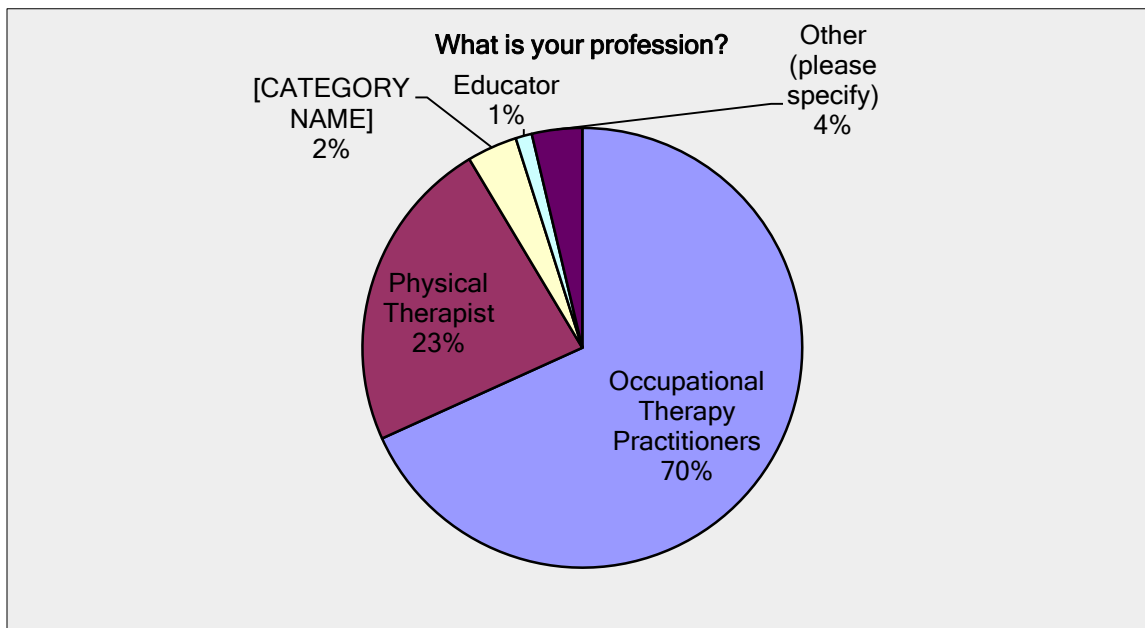
Figure . Survey respondent professions.

Participants years of professional experience. Sixteen percent of respondents had fewer than three years of professional experience, and 84% reported having three or more years of experience. Eighty-eight percent of the OTs had more than three years of experience, and among all of the OTs working primarily with SCI clients, all had more than 3 years (Table 2).

Table 2

Respondents Years of Experience

Years of experience as a therapist	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
< 1 year:	4 (5%)	4 (7%)	0
< 2 years:	5 (6%)	1 (2%)	0
2-3 years:	4 (5%)	2 (4%)	0
> 3 years:	69 (84%)	50 (88%)	13 (100%)
Total	82	57	13

Years of Experience with Assistive Technology

Fifty-one percent of all respondents reported having more than 3 years of experience prescribing or working with AT (reference Figure 2 in Appendix C). Of the OTs, 51% reported having more than 3 years of experience prescribing AT, while 54% of OTs working primarily with SCI clients had more than 3 years of experience working prescribing AT (Table 3).

Table 3

Respondents Years of Experience with AT

Years of experience prescribing AT	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
0-1 year:	16 (20%)	10 (18%)	1 (8%)
1-2 years:	8 (10%)	7 (7%)	2 (15%)
2-3 years:	11 (13%)	8 (14%)	3 (23%)
> 3 years:	42 (51%)	29 (5%)	7 (54%)
None	5 (6%)	3 (5%)	0
Total	82	57	13

Practitioner Education and Training about AT

Assistive technology exposure. Seventy-eight percent of all therapists reported

receiving AT education while in school (reference Figure 3 in Appendix C), and of the OTs, 84%

reported receiving education while in school (reference Table 4 in Appendix D).

First exposure setting for AT. A higher percentage (68.8%) of the survey respondents

received their first AT exposure and education in graduate school, 12.5% at their places of

employment, and 3.8% from continuing education courses (Figure 4). Among OTs, 70%

reported that they received some AT training in graduate school, 16% while undergraduates and

9% at work. There was no significant difference from OTs overall in comparison to OTs

working primarily with SCI clients.
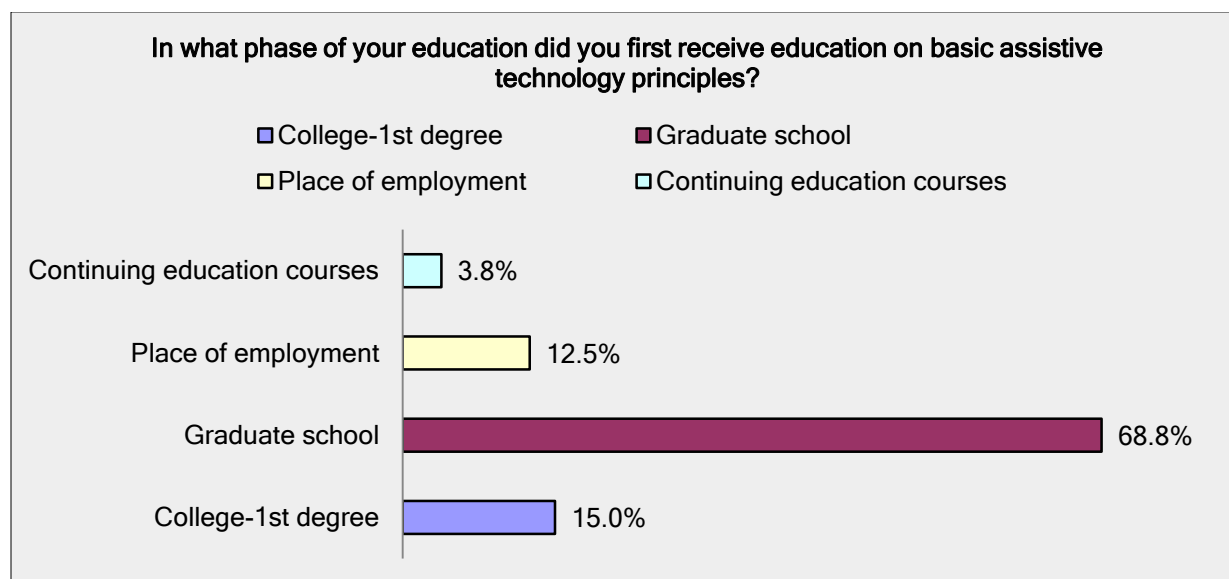
Figure 4. Education level AT education was first received.

How AT exposure was received. Among various means of receiving formal (e.g.,

continuing education courses and dedicated workshop trainings) and non-formal AT exposure

(e.g., mentorship and show-and-tell demonstration labs, where people can interact with AT

devices) most exposure occurred through workplace mentorships and in show-and-tell

demonstration labs (53%), and the least through AT workshop trainings (28%) (Reference Figure

5 in Appendix C). Among OTs working primarily with SCI clients, most training occurred

through show-and-tell labs (67%), with mentorships at the workplace being second (50%).

      Assistive technology education. Fifty-seven percent of all respondents reported that

they did not feel that they received adequate education on basic AT principles (reference Figure

6 in Appendix C). Specifically, within OT respondents, 58% reported that their education on AT

principles was not adequate and 54% of OTs working primarily with SCI clients reported the

same. This might indicate why AT provision is reported to be fragmented.

Assistive Technology in the Workplace

      Professions that prescribe AT in the workplace. When respondents were asked to rank the professions that most prescribed AT in the workplace (OT, PT, SLP), OT was indicated as the primary profession (88%) dealing with the AT provision process. (Reference Figure 7 in Appendix C and Table 4).

Table 4

Profession that most Prescribes AT in the Workplace

What profession or professions at your workplace deal with the AT provision process?	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
OT:	71 (88%)	53 (93%)	12 (92%)
SLP:	52 (64%)	36 (64%)	7 (54%)
PT:	47 (58%)	31 (55%)	6 (46%)
ATS:	16 (58%)	14 (25%)	6 (46%)
Other:	1 (1%)	0	0

Client population treated in your workplace. Stroke and SCI patients comprised 76% of patients prescribed AT devices by respondents, and others were pediatric patients and patients with brain injuries (Figure 8). Fifteen respondents skipped the question, so results are based on 67 responses. Of OT respondents, eight skipped the question, so results are based on 47 responses.
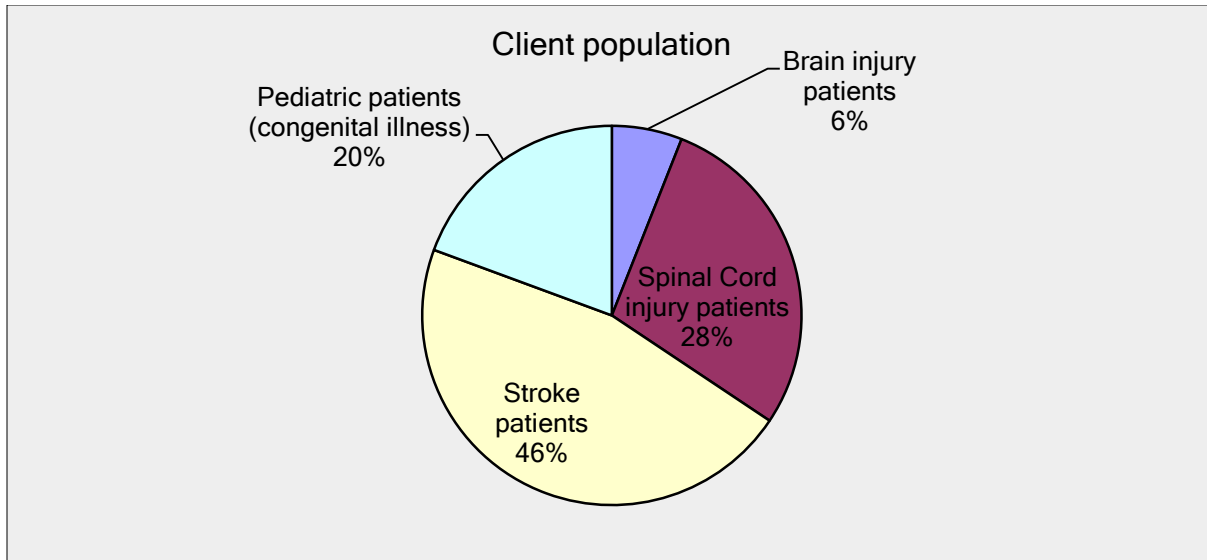

Figure 8. Percentage of clients AT devices were prescribed for in survey respondent's workplace.

Time spent prescribing assistive technology. Fifty-six percent of respondents reported

that they spent less than one hour each week addressing AT in the workplace (reference Figure 9

in Appendix C). Fifty-Four percent of OT respondents stated that they spent less than 1 hour

each week addressing AT needs for patients at work, and 23% spent 2 to 4 hours, followed by

14% spending over 6 hours each week. Among SCI OTs, 31% reported spending more than 6

hours each week addressing AT issues, and 38% less than 1 hour.

Table 5

Amount of Time Spent on AT in a Week

How much time a week do you spend on AT?	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
< than 1 hr:	46 (56%)	31 (54%)	5 (38%)
Between 2-4 hrs:	18 (22%)	13 (23%)	2 (15%)
Between 4-6 hrs:	7 (9%)	5 (9%)	2 (15%)
> than 6 hrs:	11 (13%)	8 (14%)	4 (31%)
Total	82	57	13

Satisfaction levels with AT procedure in the workplace. When asked how satisfied they were with current AT prescription, 6% of respondents reported being satisfied, 67% were either somewhat satisfied or neutral, and 26% were somewhat dissatisfied or dissatisfied (reference Figure 10 in the Appendix C). This was reflected in responses from OTs, with the majority neutral to dissatisfied with their current workplace AT procedures (Table 6).

Table 6

Satisfaction Levels with Current Workplace AT Procedure

Level of satisfaction	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
Very satisfied:	5 (6%)	4 (7%)	1 (8%)
Somewhat satisfied:	21 (26%)	15 (26%)	3 (23%)
Neutral:	34 (41%)	24 (42%)	6 (46%)
Somewhat dissatisfied:	16 (20%)	12 (21%)	2 (15%)
Dissatisfied:	6 (7%)	2 (4%)	1 (8%)

Confidence levels with prescribing AT in the workplace. Seventy-seven percent of all

respondents were confident to very confident when selecting and recommending low-tech AT to

patients, and 25% were confident to very confident with prescribing high-tech AT devices

(Figures 11 and 12 in the Appendix C, and Table 7). Among OTs working primarily with SCI

clients, 92% reported being somewhat confident to very confident dealing with low-tech AT, and

77% with high-tech AT.

Table 7

Confidence Levels with Low and High Tech AT Prescription

Confidence in Prescribing AT:	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
low-tech AT	Very confident: 41 (50%)	29 (51%)	6 (46%)
	Confident: 22 (27%)	15 (26%)	4 (31%)
	Somewhat confident: 10 (12%)	6 (11%)	2 (15%)
	Neutral: 5 (6%)	3 (5%)	1 (8%)
	Not confident: 4 (5%)	4 (7%)	0
high-tech AT	Very confident: 6 (7%)	4 (7%)	2 (15%)
	Confident: 14 (17%)	13 (23%)	4 (31%)
	Somewhat confident: 18 (22%)	11 (20%)	4 (31%)
	Neutral: 12 (15%)	6 (11%)	0
	Not confident: 31 (38%)	22 (39%)	3 (23%)

Current workplace processes for AT. Regarding having a standard evaluation process and data collection form for AT provision, 12% had a pre-existing form and 88% had none (reference Table 8 in Appendix D).

Fifty-eight percent of respondents reported that no theoretical model guided their prescriptions. Of the remaining 42%, 14% reported using HAAT, 25% used MPT, and 3% reported using the Lifespace access profile (reference Table 9 in Appendix D).

Thirty-three percent of respondents believed that theoretical models were important when prescribing AT. Fifteen percent felt it was "somewhat important", 29% "neutral" and 14% felt it was "not important" to consider a theoretical model in the AT process.

Available state resources. Over half of OTs indicated that they were unaware of their respective states' funding, education, and provisional resources , compared to 91% of occupational therapists working primarily with the SCI population were aware.

Open-ended questions

Respondents were asked two open-ended questions that pertained to the survey. The first question asked respondents what resources they shared with their clients during the AT process, 40 of the 82 survey participants responded and text analysis revealed that 15% shared information on AT companies, 12.5% shared information on AT equipment, and 10% shared information on local resources and insurance information. The second open-ended question asked respondents to identify barriers to AT provision. Of the 82 survey participants 55 responded with 25% identifying insurance as a primary barrier to AT provision, followed by cost (18%) and funding (18%), and lack of AT knowledge (9%). Lastly respondents were allowed to make additional comments about issues associated with AT provision, client factors such as,

education level, motivation level, family/community support, and the clients' receptiveness to equipment and technology were identified as additional barriers to AT provision.

Preferred medium to access educational tool for AT

When questioned about how practitioners might prefer to access and interact with a resource tools, respondents identified apps for mobile devices as the preferred medium, followed by a website and then informational booklet. Among OTs, the website format was ranked highest, followed by an app and informational booklet. Among OTs working primarily with SCI clients, the website was reported as the most practical means to receive and use information regarding AT for clients.

Summary

Several rehabilitation disciplines responded to the open and close-ended questions in the survey. Most respondents reported that there was no standard AT assessment tool or theoretical model that guided the AT process in their respective workplaces. Respondents also reported that confidence levels were lower when prescribing high-tech AT in comparison to low-tech AT. Additionally from the open-ended questions, respondents identified medical insurance benefits as a key barrier to AT provision along with certain client factors. Furthermore, occupational therapists that work primarily with SCI clients spent more time during the week addressing the AT needs of clients in comparison to other therapists. Specifics of these findings are discussed more comprehensively in the following chapter.

Chapter 5: Discussion

Analysis of the survey data, through open-ended and close-ended questions, provided insights into current occupational therapists' AT prescription procedure and confidence with selecting and educating clients about AT. The survey respondents and AT specialists identified several barriers to AT provision, including financial barriers (e.g., cost of AT, insurance benefits, and lack of funding), lack of knowledge (e.g., locating AT, and from whom and where to learn about AT), and lack of equipment for trials. Respondents also identified client factors such as, education level, motivation level, family/community support, and the clients' receptiveness to equipment and technology as additional barriers to AT provision.

Remarkably, Fifty-seven percent of all respondents reported that they did not feel that they received adequate education on basic AT principles while in health profession school. Specifically, within OT respondents, 58% reported that their education on AT principles was not adequate and 54% of OTs working primarily with SCI clients reported the same. This might partially account for the fragmented system reported in the literature. In addition, 84% of respondents reported having three or more years of professional work experience in their respective positions, but only 51% of these same respondents reported having more than 3 years of experience prescribing or working with AT. Within the subgroup of OTs working with the SCI population, 100% of the therapists had more than 3 years of professional experience, but only 54% reported having more than 3 years of experience working with or prescribing AT. This shows that although most of the occupational therapists that work primarily with the SCI population had more than 3 years of experience, this did not translate into increased interaction with AT or experience with the AT prescription process.

Forty-six percent of OTs who primarily treated SCI clients reported spending more than 4 hours each week prescribing AT, reflecting the notion that the SCI population requires more AT support than the other populations treated by the respondents. It is not surprising that occupational therapists working with the SCI population spend more hours weekly addressing AT-related matters due to the unique needs of this client population. Eighty-eight percent of survey respondents reported being comfortable with low-tech AT provision and education, but occupational therapists working with the SCI population were more confident prescribing high-tech AT than OTs who did not work primarily with SCI patients. This might be because occupational therapists working with the SCI population are more often exposed to complex AT devices and equipment because of the client population they serve. Similarly, OTs who worked primarily with SCI clients were more aware than other OTs of state resources available for AT procurement (91% versus 47%).

All OTs reported that an AT assessment tool was not available at their workplaces. Within the OTs who did have a workplace process for AT procurement, a majority expressed dissatisfaction with their workplaces' AT procurement procedures. Most therapists reported that no framework guided the prescription process at their respective workplace and did not feel that it was important to utilize a theoretical model to guide AT prescription. Among therapists who had a prescriptive process in place, the Matching Person Technology Model was identified as the most common model used to guide their practice, but amongst occupational therapists working with the SCI population, the Human Activity Assistive Technology Model was identified as the most common model used in their workplaces.

When the survey asked what format respondents preferred receiving information and education on AT devices and funding (i.e., mobile device app, informational booklet, portable

decision wheel, or website), the majority reported a preference for a mobile device app. However, OTs working primarily with SCI clients reported a preference for a website. Feedback on this question informed the author's decision to create a website focused on assisting the population of OTs who are working with the SCI population.

Below are two quotes that exemplify the sentiment of many survey respondents taken from two OT practitioners:

"Generally, I believe there is an overall gap in expertise among those who are most often in a position to prescribe AT. There is so much out there, so it's overwhelming for most clinicians, who are often afraid of making the wrong choice for their patient, or just don't have the time to learn about all the options. Technology also changes rapidly, so keeping AT labs up to date and learning about new technologies are both costly and time-consuming. Additionally, many patients (and sometimes family) are apprehensive to pursue assistive technology, as they perceive it as "accepting disability," and it signifies a loss of hope. Finally, lack of funding for many assistive technology devices that can increase independence and quality of life is also a barrier" (OT #1).

"For me, funding is the biggest barrier. Also matching the appropriate technology to the person, when you don't have access to trial equipment (a real problem if what you thought would work doesn't); acceptance by the client (not so much a problem if you have a good working relationship); often difficult to get enough sessions paid for; not enough practitioners well trained in providing client centered AT services. Many clients don't have health insurance. I live in a rural area, and transportation to the various programs can be an issue, and people are very self-reliant and don't like to ask for help.

It can be difficult to get your foot in the door. Even if you do Home Health, the distances

are great and you don't get much follow-up" (OT #2).

Findings from the survey aligned with the author's assertion through experience and the

literature review that therapists of all experience levels do not perceive that they are proficient in

the area of AT prescription, and more needs to be done to improve therapists' understanding,

familiarization, and confidence with AT provision. The survey respondents identified a need for

improved education and training on several aspects of AT procurement, improved access to AT

equipment, and identified the use of a website or app as a practical medium to access information

on AT. These findings helped the doctoral student in the selection of what information to

include within the developed resource tool.

Residency Reflection

Exchanges with Mr. Laredo allowed the author to gain insights into the challenges

educators and mentors face when training OTs, such as difficulties with providing adequate

mentorship to therapists due to time constraints (e.g., patient treatments, administrative duties,

and meetings). The author found this interesting because although the literature identifies

mentorship as a solution to increasing therapists' AT knowledge, the time component is an

institutional factor that might prohibit it from occurring. Institutions do not always consider

mentorship time to help therapists receive the guidance and training time needed to provide AT

training and education to clients, so if inexperienced therapists want more education or

mentorship, they must seek them on their own time.

During the AT fundamental course in Boston, MA, the author learned about disabilities

that commonly require AT (including the SCI population), components of an AT assessment,

and identified barriers with AT service delivery and funding. This was useful knowledge and

information for the doctoral student in the beginning of the capstone project because it

reintroduced basic AT concepts and terminology. The experience gained during residency

reinforced the knowledge gained by the doctoral student in OT graduate school, literature

reviewed for the capstone project and from the author's experience as an occupational therapist

working the SCI population with AT.

The author's experience at WRNMMC was unique in that all of the interactions

regarding AT were with AT specialists, and the majority of the clientele were affiliated with the

United States military. Clients largely used Tricare, a healthcare program of the United States

Department of Defense Military Health System, as their funding source. Consequently, clients

were able to receive most of the assistive devices or equipment that were recommended for them

by therapists and ATS. Due to the payer source, therapists did not appear to have the same time

limitations as therapists in other healthcare settings related to delivery of education and training

to clients do. ATS were also able to follow up with clients after discharge regarding their

prescribed AT devices. The ability to follow up after discharge appeared to mediate device

abandonment from clients. Additionally, the knowledge gained about AT devices and state

resources from the D.C. ATP program was helpful in the development of the resource tool, and

enhanced the doctoral students understanding of the use of technology in helping different levels

of clients with SCI.

Unanimously, the AT specialists discussed the concept of abandonment, and confirmed

the importance of matching AT devices and equipment with a client to ensure a good fit. In

addition, they identified follow-up with the client could mitigate abandonment. They shared

several examples in which clients were provided with AT equipment and on follow-up visits

neither the client nor their families used the equipment. This was attributed by the AT specialists

to discomfort with the equipment or resistance from the client or family members regarding use

of new technology or a change to routines. The AT specialists that work outside of WRNMMC

reported issues with funding sources as a common barrier to AT provision. They also mentioned

that they make efforts to provide information to their clients and the families about available

state and national funding resources via pamphlets, informational packets, and through websites

online. The specialists spoke at length about how traditional funding sources such as private

insurances and Medicaid were not paying for equipment that were recommended and necessary

for clients. The specialists confirmed that there was a need for improved AT education and

training for therapists while in graduate school, which should at least provide OT students with

information on where to learn more about AT devices and training courses. In agreement with

the literature, the specialists spoke about the complexity of prescription. Numerous factors to be

considered during prescription should include a client's funding resources, physical

characteristics, the environments in which clients would use AT device, AT device aesthetics,

and a client's family preferences prior to reaching a decision regarding equipment. Due to this

complexity, the experts agreed that therapists require continuing education and training on

current AT and related equipment, and that therapists must be cognizant during prescription to

include clients and families during decision-making. Four of five specialists at all the sites

identified using the HAAT model, albeit inconsistently, as a guide when selecting AT devices,

but reported that it was difficult to use a standardized tool to assess clients' AT needs. They

disclosed that they use informal assessment methods such as interviews and observations, and

experience to make decisions about which assistive technology devices to recommend and trial.

Reason for Website Formation

The decision to create a resource tool in website format evolved throughout the capstone. The author initially wanted to create a portable tool such as a pamphlet or paper decision wheel that offered easy access to therapists for use while working with clients. The author considered problems associated with creating a paper tool, including difficulty with updating such a tool annually and condensing all AT information into a small space. These difficulties shifted the author's thinking toward creating a tool in a digital format such as a mobile app. This idea was shared with the capstone residency advisors, and was included in the subsequent survey. Some therapists suggested that an app was a good idea, but the majority preferred to use a website. In addition, creating an app appeared to be cost prohibitive and time intensive for the author, so the author explored the website format. This was a favorable idea due to how easy it is for therapists to access information from websites through mobile devices and computers. Analysis of survey results assisted the author with creation of the ATPT-OT in website format. The content of the website was determined through completion of the literature review, interactions with and knowledge gained from the author's residency experiences, and on-going feedback from capstone advisors. The author believed it was important to create a website that was easily accessible through a mobile platform throughout the workday or when working directly with clients. The website was simplified to ensure easy navigation by therapists, and the homepage was designed as a simple introductory page that provides information about the tool, with a hyperlink at the bottom that links directly to the tool.

In the "Guidance tab", users can find a diagram created by the author that highlights a suggested AT provision process for therapy practitioners. Other diagrams that explain current treatment models used for AT provision can also be found within this "Guidance tab". In the

"Resources tab", the author provides information regarding resources for funding and AT

procurement due to the importance placed on this topic by residency advisors, by survey

respondents, and in the literature. Development of the "Resources tab" was accomplished by

providing links to each states' AT program, which includes information about demonstration

labs and loaner programs. The information on each state's AT program demonstration labs and

loaner programs was placed at the top of the resource section due to its importance, as identified

by the ATS and survey respondents. The author wanted to provide information on various

technologies that might be beneficial to clients with SCI, and therefore one section was dedicated

to environmental controls and modifications, car modifications, and wheelchairs. In the SCI

section, additional websites were added to offer personal stories and insights that practitioners

might find useful.

The literature contains many examples of AT abandonment. The author addresses this

topic by dedicating a section of the website to causes of abandonment and solutions to alleviate

the outcomes of this phenomenon. A tab titled "Contact Us" was added to enable users to send

questions and feedback about the website to the doctoral student, which should lead to improving

the utility and effectiveness of the website. A tab titled "Connect" provides a link to a Facebook

page that was created for the website to foster online communication and support for OTs and

AT specialists. All aspects of the website and questions or comments will continue to be

addressed by the doctoral student. The author will also maintain the content of the website and

Facebook page. The website was launched in August 2015 and has been receiving

approximately 50 visits a month and the Facebook group currently has 39 active members.

Conclusion and Implications

   Conclusion. Assistive technology provision for SCI clients is complex. Through a

comprehensive literature review, residency with AT specialists, and a survey administered to

rehabilitation therapists, the author identified areas for improvement and possible solutions to

improve the process. Issues identified in the literature and survey included lack of access to AT

equipment for testing, lack of time for therapists to receive mentorship, limited knowledge about

AT and funding resources for AT, low confidence with high-tech AT, and lack of uniform AT

assessment. Proposed solutions included mentorship, increased education and training, and use

of a collaborative approach with clients to recognize individualized needs. Two occupational

therapy frames of references and three assistive technology frameworks/models were identified

and integrated in the design of the ATPT-OT resource tool to lessen abandonment for clients.

These included the OT frames of reference (MOHO and PEOM) and the AT frameworks/models

(HAAT, MPT, ATSM, and SETT). Also, two assessment tools, the Assistive Technology

Device Predisposition Assessments (ATDPA) and Quality of Life Index-Spinal Cord Injury

(QLI-SCI) were provided for therapists to use during the prescriptive process. The assistive

technology specialists recommended using informal interviews (i.e., occupational profiles) with

SCI clients to gather relevant information pertaining to clients' occupational histories,

experiences, and needs (AOTA, 2008) to facilitate a client-centered AT intervention. Similarly,

the assistive technology specialists recommended the use of observation of clients to help inform

decisions by therapists, to facilitate a better match between the client and equipment to help

improve AT use and lesson AT abandonment. The doctoral student reviewed the literature,

applied existing frameworks and methods, completed a residency program, and asked for expert

advice to create the ATPT-OT (www.atpttool.com) website (Figure 9).

Tool use

1. Select a SCI level from the 4 selections available
2. Then click your mouse on relevant co-morbidity to see recommended equipment
3. Review recommended AT devices (some recommended equipment have AT hyper-links attached to it for easy access of a visual representations of the equipment)

LEVEL OF SPINAL CORD INJURY	CO-MORBIDITIES	RECOMMENDATION
CERVICAL	Visual Deficits	**Recommendation for Cervical level SCI with visual deficits**
THORACIC	Dexterity	
	Hearing Deficits	
LUMBAR	Cognitive Deficits	
SACRAL	None	

Mobility: Power wheelchair with attendant control and vent tray (depends on client's SCI level), and possible use of dog-guides

Computer Access: Alternate keyboards: on-screen or mini, quad joy or head mouse, eye gaze system (smart nav), Dragon natural speaking, voice command systems, magnifying software for computer

EADLs: possible need for switch or voice access; self-feeders, magnifiers, talking calculator

Communication Devices: switch access via sip and puff, quad joy, head mouse, smart nav, head or tongue control to a cellphone with voice control (newer phones have capability to work with switch access) infrared

Things to consider when choosing AT

B. What movements the client has available?

C. Possible access points on client (head, chin, cheek, hands, elbow, knees, feet)

D. Clients familiarity with technology or openness for technology

E. Client goals

F. Clients psychosocial information
   a. Poor safety awareness
   b. Suicidal ideation

G. Environmental concerns
   a. Where will equipment be used? (home, work, leisure, play   or school, rural vs city)
   b. Identified environmental and social barriers

H. Mounting: where will AT be mounted?
   Avoid mounting to movable components
   Mount above the tilt, if a tilt is present
   Consider a locking frame clamp if tilt is present

MOST IMPORTANTLY IF YOU CAN THINK OF AN AT SYSTEM, IT CAN BE CREATED.

Figure 9. Screenshot of ATPT-OT tool website.

Figure 10. Screenshot of ATPT-OT collaborative Facebook page.

Elsaesser and Bauer (2011) argue that lack of a standardized AT service method led to a "fragmented assistive technology service system," with ineffective communication among providers, manufacturers, and clients, resulting in inefficient resource allocation and suboptimal outcomes (p. 386). The current author's survey and capstone project add to the OT knowledge base and address problems of a fragmented AT service system, and the phenomenon of abandonment. This was conducted by providing information on the website regarding AT prescription and assessment, links to funding and equipment loaner resources, and access to an online Facebook community of therapists and assistive technology specialists to foster communication and mentorship.

Limitations. Although an online survey was an economical way to access the greatest number of therapists possible, limited responses were gathered. The survey was reviewed by 5 therapists to identify instrument deficiencies and make improvements to the questions and survey design, but it might have been flawed grammatically. The author sought to gather information from 25 to 50 OT practitioners who worked primarily with SCI clients, but was able to survey only 13 who met that criterion. The other 43 OT practitioners might not have worked primarily

with SCI clients, but they nonetheless provided valuable information regarding experiences with

AT education, training, and provision. The wording of several of the questions might have been

confusing to respondents, as indicated by comments written in the feedback section, and

questions that were answered partially or incorrectly. This might have affected interpretation.

Closed-ended, multiple-choice questions might have resulted in richer, more useful data. Results

from this study might not generalize to all therapists in the United States, but they still identify a

need for improved AT education and training for therapists, confirming what was found during

the literature review pertaining to AT barriers and solutions.

  Implications. This capstone project offers insights into barriers identified by OTs who

work in AT provision in an inpatient context, and develops a resource tool to help therapists

during selection of AT for clients. The AT needs of individuals with disabilities fall in the OT

scope of practice. More exploration is required on AT provision, processes for delivery by

therapists, and contributions OTs make to ensure individuals with disabilities receive AT

devices. Ongoing investigation is required that considers the evolution of technology in society

and its potential uses for people with SCIs. To prepare entry-level OTs with knowledge needed

to usher the profession toward the 2017 Centennial Vision, entry-level curricula should be

enriched or expanded to address AT information and instruction comprehensively for OT

students. And as suggested by the author's capstone supervisors, there is a need for improved

AT education and training for therapists while in graduate school, which should at least provide

OT students with information on where to learn more about AT devices and training courses. In

addition, mentorship is an important tool that can help therapists continue to improve their AT

knowledge and comfort, but institutions must be willing to enable this by building the time

allowance into therapists weekly schedules. Furthermore, therapists show a lack of satisfaction

with current workplace AT prescription guidelines, which shows a need for a standardized or more formal process for AT procurement.

Future tools or programs that address these issues need to be accessible, functional, and in a format that is readily available to therapists. They should provide information about local, state, and federal resources that therapists can use during selection of assistive devices. Tools created for therapists should also provide information about where additional education and training can be found, including continuing education courses. A tool should be available and easy to use by therapists in their respective work settings, and feature a link to the AOTA website for additional AT support and professional updates. Questions for future inquiries include:

- Does use of the Assistive Technology Prescription Tool for Occupational Therapists in inpatient settings affect confidence with AT provision positively?

- Does the Assistive Technology Prescription Tool for Occupational Therapists help OTs during AT selection with education, trials, and recommendations regarding clients?

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Appendix A

Sample Survey

1. Gender:

   a. Male
   b. Female

2. How many years have you been a therapist?

   a. Still in school
   b. Less than 1 year
   c. Less than 3 years
   d. More than 3 years

3. How many years of experience do you have with prescribing or working with assistive

   technology?

   a. Less than 3 years
   b. More than 3 years
   c. None

4. In what phase of your education did you first receive education on basic Assistive

   technology principles?

   a. College-1st degree
   b. Graduate school
   c. Place of employment
   d. Continuing education courses

5. What type of training or education have you received on assistive technology?

   a. Dedicated workshop training
   b. Continued education courses
   c. Mentorship at place of employment
   d. Other _____

6. Were you satisfied with the level of education you received on basic assistive technology

   principles?

   a. Very satisfied
   b. Somewhat satisfied
   c. Neutral
   d. Somewhat dissatisfied
   e. Very dissatisfied

7. Who are you mostly prescribing assistive devices to?

    a. Spinal cord injury patients
    b. Brain injury patients
    c. Pediatric patients (congenital illness)
    d. Stroke patients

8. What percentage of time do you spend in a week addressing assistive technology needs of

   patients?

    a. Less than 25%
    b. About 50%
    c. Less than 75%
    d. More than 75%

9. How satisfied are you with your current assistive technology prescription procedure?

    a. Very satisfied
    b. Somewhat satisfied
    c. Neutral
    d. Somewhat dissatisfied
    e. Very dissatisfied

10. How confident are you in selecting, educating, and recommending low-tech assistive

   devices to patients?

    a. Very confident
    b. Confident
    c. Somewhat confident
    d. Neutral
    e. Not confident

11. How confident are you in selecting, educating, and recommending high-tech assistive

   devices to patients?

    a. Very confident
    b. Confident
    c. Somewhat confident
    d. Neutral
    e. Not confident

12. Do you follow a certain model or format when providing assistive technology?

    a. Yes
    b. No

If yes, what model? _____

13. Does your knowledge of theoretical models influence your prescription of AT?

    a. Yes

             b. No

If yes? _____

14. How important is knowledge of theoretical models to you when prescribing assistive devices to clients?

        a. Very important
        a) Important
        b) Somewhat important
        c) Neutral
        d) Not important

15. What do you find to be the biggest barrier for you when trying to select assistive technology to educate, trial, and ultimately recommend for patients?

_____

16. In what format would you most likely use an educational tool that helps with assistive technology provision in the clinical environment?

        a. As an app for phone
        b. In a 3-ring binder

17. Would you be interested in testing a portable and easily accessible tool that is helpful in the assistive technology provision process? If yes enter email address below:

        a. Yes
        b. No

Comments: _____

Appendix B

Revised Survey

Page 1:
Thank you for taking part in my capstone study. My project is focused on exploring issues associated with assistive technology provision and possible solutions. The survey should take less than 5 minutes to complete.

Thank you for participating in this survey.

Page 2:

1. What is your gender?

   a. Male
   b. Female

2. What is your profession?

   a. Occupational Therapist
   b. Physical Therapist
   c. Speech Language Pathologist
   d. Educator
   e. Other (please specify)

3. How many years have you been a therapist?

   a. Less than 1 year
   b. Less than 2 years
   c. More than 2 years, but less than 3 years
   d. More than 3 years

4. How many years of experience do you have with prescribing or working with assistive technology?

   a. 1 year
   b. 1-2 years
   c. 2-3 years
   d. More than 3 years
   e. None

5. Did you receive education on assistive technology in school?

   a. Yes
   b. No

6. In what phase of your education did you first receive education on basic assistive technology principles?

    a. College-1st degree
    b. Graduate school
    c. Place of employment
    d. Continuing education courses

7. What type of training or education have you received on assistive technology?
    a.
    b. Dedicated workshop training

    c. Continued education courses
    d. Mentorship at place of employment
    e. Show and tell lab
    f. Other (please specify)

8. Do you think you received an adequate amount of education on basic assistive technology principles?

    a. Yes
    b. No

9. What profession or professions at your workplace deals with the assistive technology provision process?

    a. Occupational Therapy
    b. Speech Language Pathologists
    c. Physical Therapist
    d. Assistive Technology Specialists
    e. Other

10. For whom are you or have you mostly prescribed assistive devices?

    a. Brain injury patients
    b. Spinal Cord injury patients
    c. Stroke patients
    d. Pediatric patients (congenital illness)
    e. Other

11. How much of your workweek is dedicated to addressing assistive technology needs of patients?

    a. Less than 1 hour
    b. Between 2-4 hours
    c. Between 4-6 hours

    d. Greater than 6 hours

12. How satisfied are you with your current assistive technology prescription procedure?

    a. Very satisfied
    b. Somewhat satisfied
    c. Neutral
    d. Somewhat dissatisfied
    e. Dissatisfied

13. How confident are you in selecting, educating, and recommending low-tech assistive devices (reachers/grabbers, large print text, canes and walkers) to patients?

    a. Very confident
    b. Confident
    c. Somewhat confident
    d. Neutral
    e. Not confident

14. How confident are you in selecting, educating, and recommending high-tech assistive devices (power wheelchairs, computers with specialized software such as voice recognition, etc.) to patients?

    a. Very confident
    b. Confident
    c. Somewhat confident
    d. Neutral
    e. Not confident

16. Do you have a standard process or standard evaluation form for assistive technology provision?

    a. Yes
    b. No
If yes, please specify _____

17. What theoretical model guides the prescriptive process?

    a. Human Activity Assistive Technology (HAAT) model
    b. Matching Person and Technology (MPT) model
    c. Lifespace Access Profile
    d. None
    e. Other (please specify)

18. How important is knowledge of theoretical models to you when prescribing assistive devices to clients?

a. Very important
b. Important
c. Somewhat important
d. Neutral
e. Not important

19. What resources do you share with your patients about AT procurement?

20. Are there resources in your state that you are aware of for assistive technology procurement?

a. Yes
b. No
   Please specify _____

21. Can you identify the barriers that affect assistive technology provision?

22. Which of the following formats would you most likely use in your clinical environment? Please rank.

a. An app for phone or iPad
b. An informational booklet
c. Portable decision wheel
d. Website

23. Would you be interested in testing a portable and easily accessible tool that could be helpful in the assistive technology provision process? If yes, please leave contact information below.

a. Yes
b. No

24. Contact Information
   Name
   Address
   City / Town
   State / Province
   ZIP / Postal Code
   Email
Additional Comments/Feedback for researcher: _____

Appendix C

Figures from Survey Responses
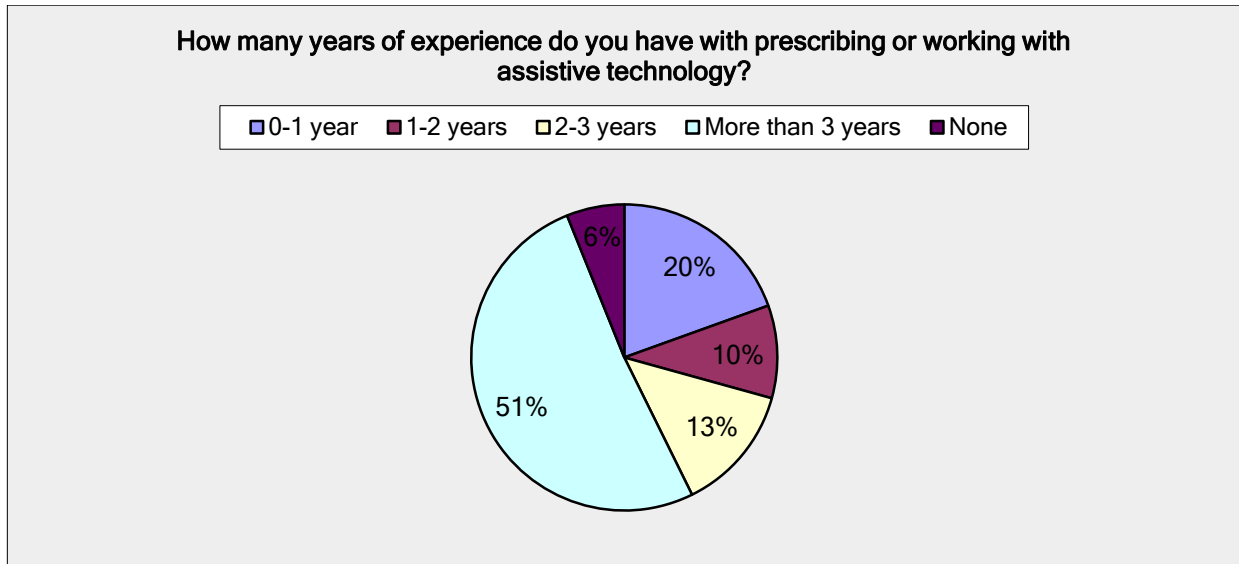
Figure 2. Number of years of experience respondents have with AT.
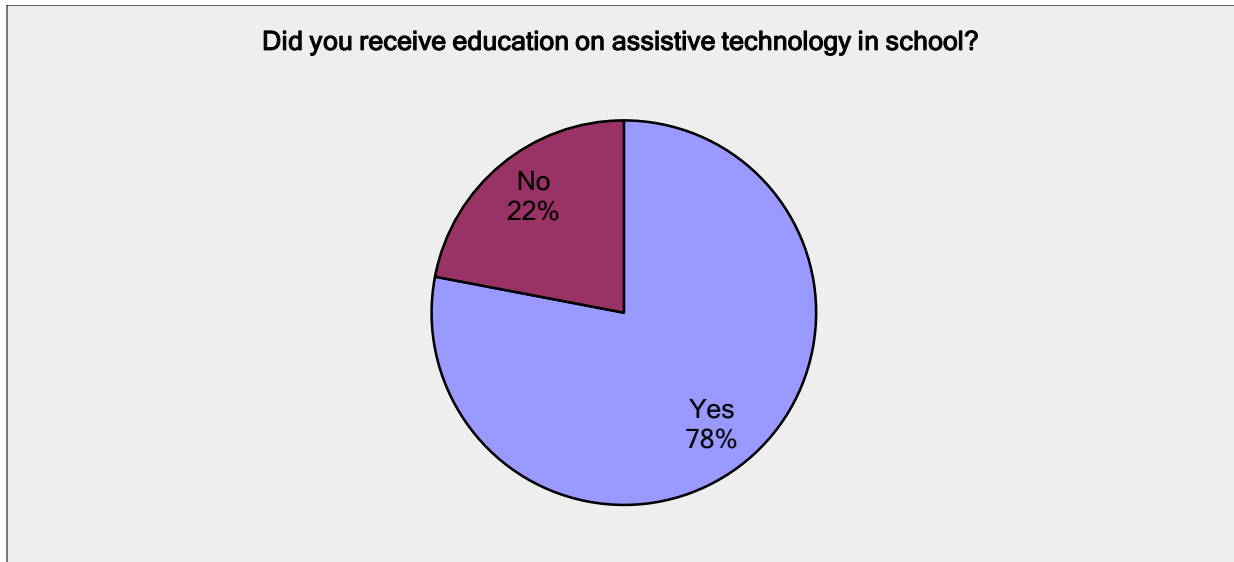
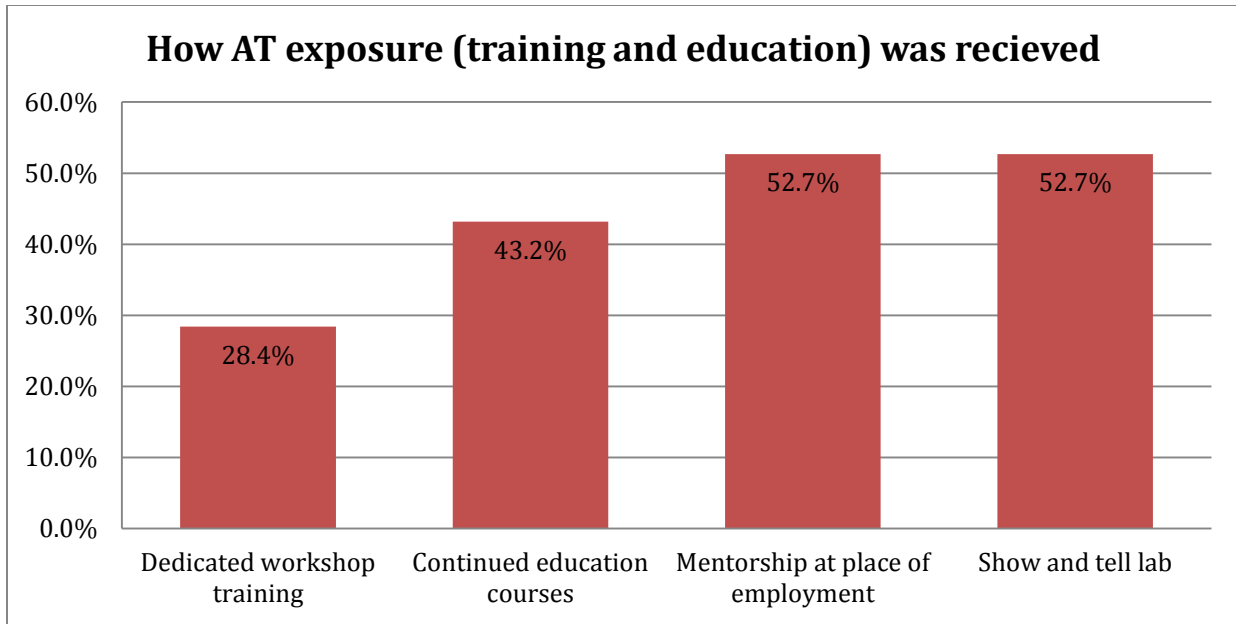*Figure 3.* Percentage of respondents that received AT education while in school.

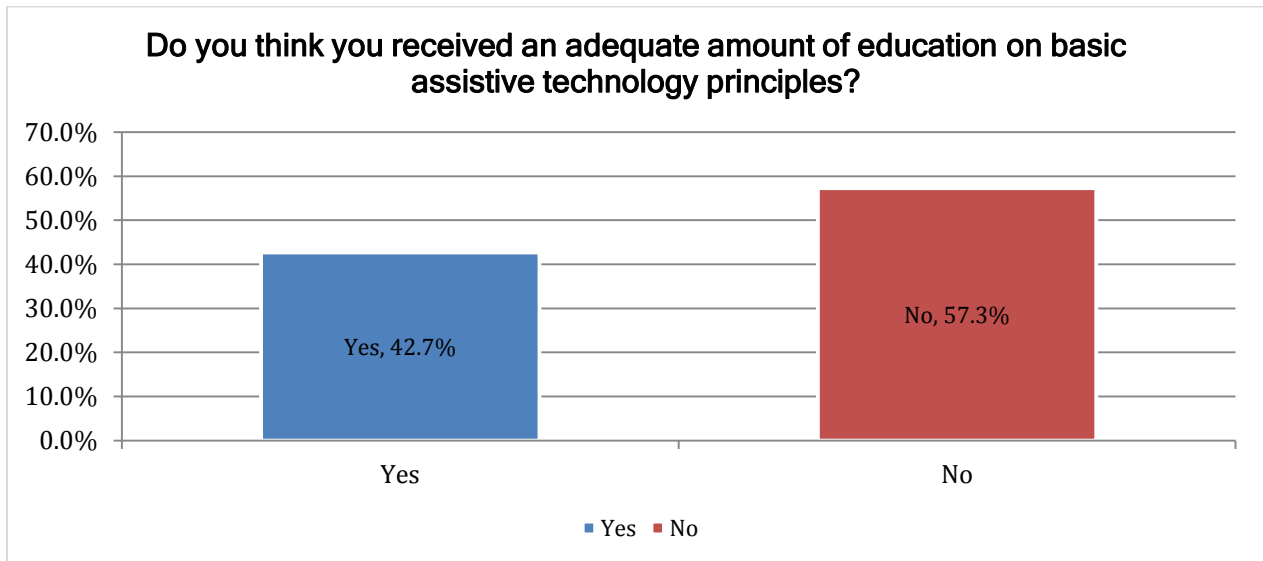*Figure 5*. How AT exposure was received.

Figure 6. Percentage of respondents who believe they received adequate amount of education on
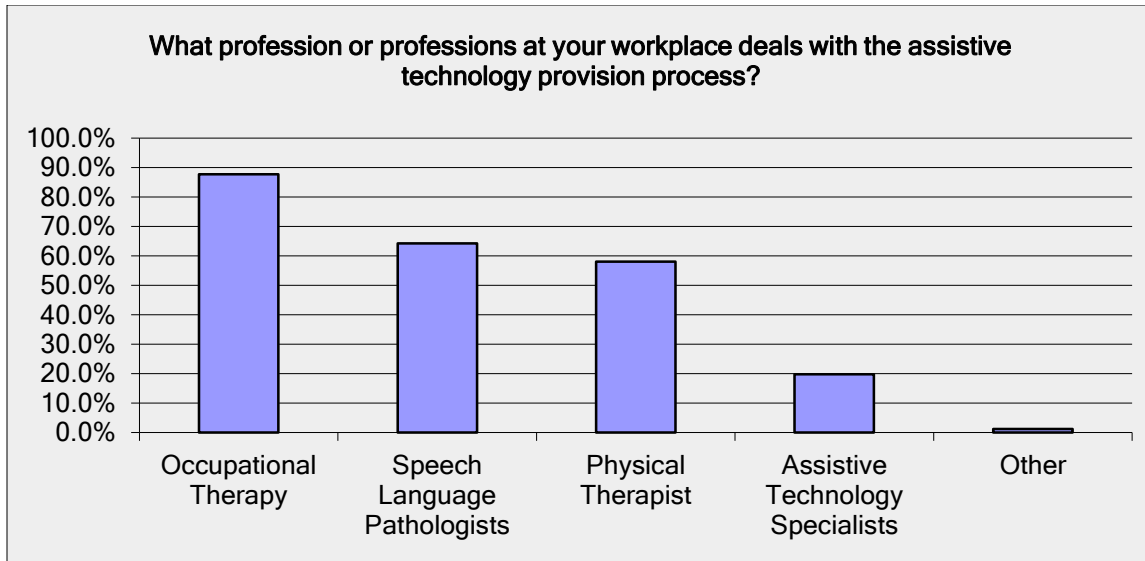
AT.

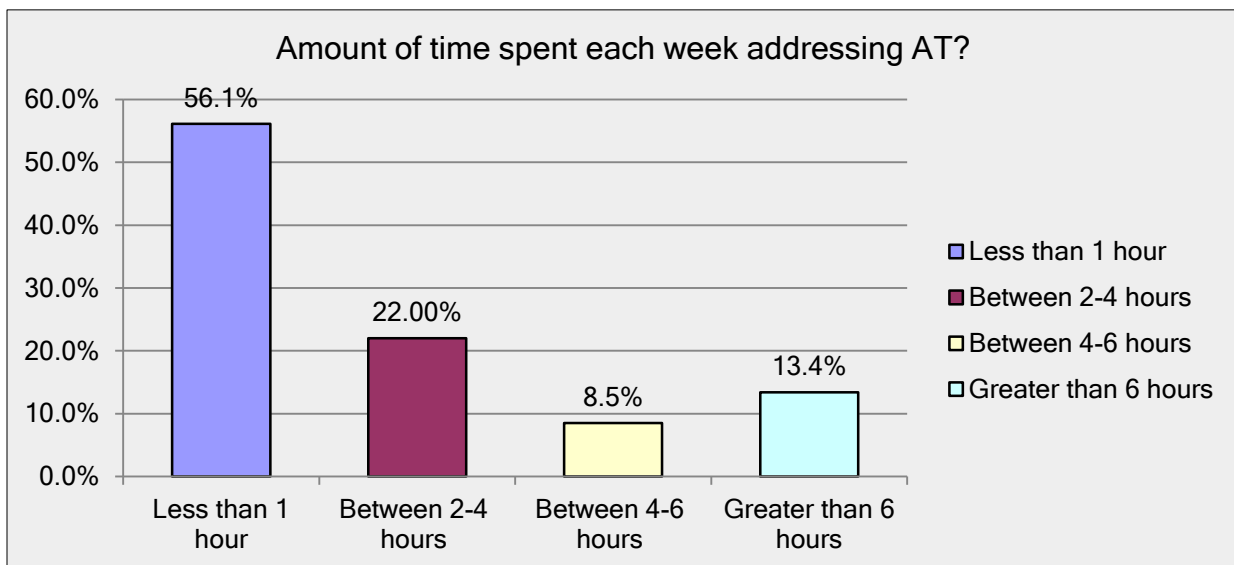*Figure 7.* Professions that address AT in the workplace.

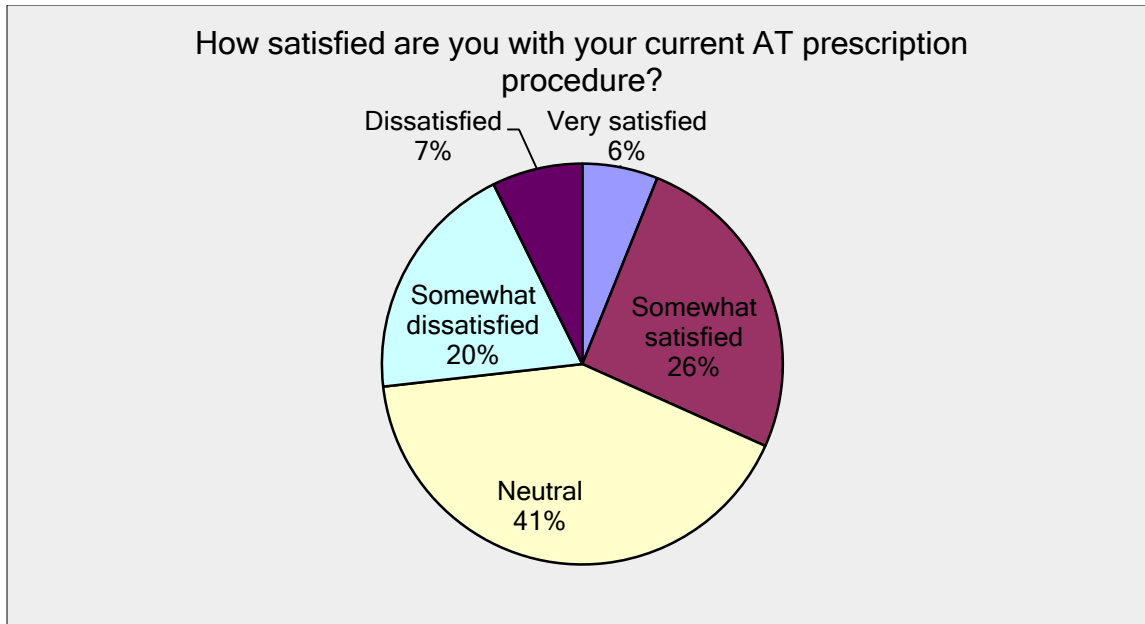*Figure 9.* Percentage of amount of time respondents spent at work addressing AT each week.

Figure 10. Satisfaction level of respondents with current work AT prescription procedure.
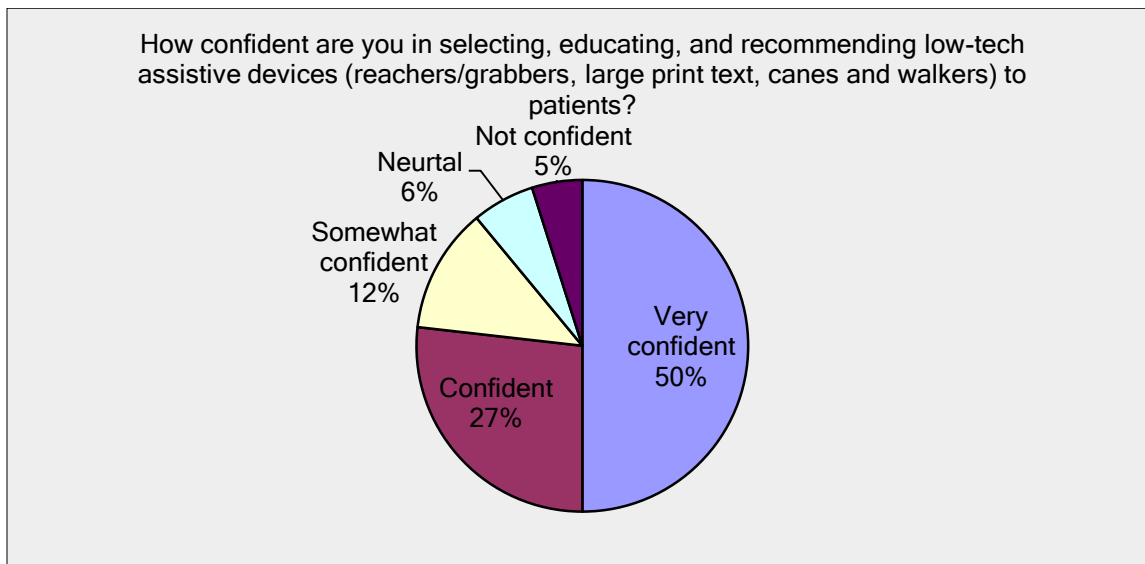

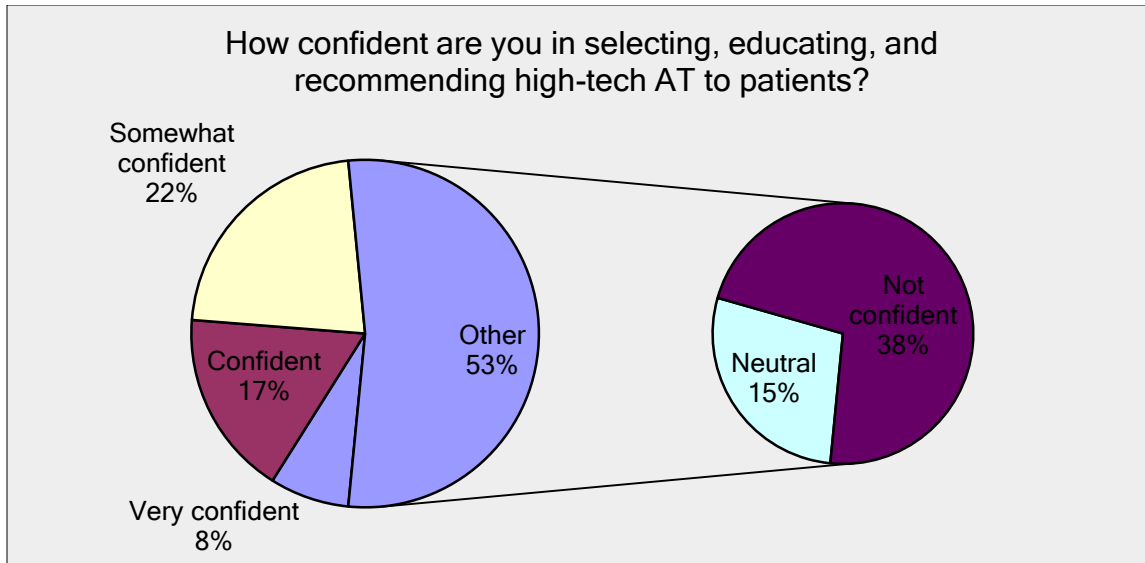*Figure 11.* Confidence level of respondents with low-tech AT.

Figure 12. Confidence level of respondents with high-tech AT.

Appendix D

Tables

Table 8

Established AT Form

Do you have an established evaluation form for AT at your work?	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
Yes:	10 (12%)	4 (7%)	1 (8%)
No:	72 (88%)	52 (93%)	12 (92%)

Table 9

Theoretical Models that are being used in the Workplace

What theoretical model guides your work?	All Respondents (PT, OT, SLP, etc.)	Occupational Therapists	OTs working with SCI clients
HAAT:	(11) 14%	10 (18%)	4 (37%)
MPT:	(20) 25%	15 (27%)	2 (15%)
LAP:	(2) 3%	2 (4%)	0

None:	(46) 58%	32 (58%)	6 (46%)
Other:	6 (8%)	2 (4%)	2 (15%)