Improving the Independence of People with Disabilities by Identifying Assistive Technologies for Their Homes

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Project Centre: Melbourne Australia D'15

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Abstract

The goal of this project was to assist the E.W. Tipping Foundation with providing its clients a range of technology options that could improve their quality of life and independence. We interviewed clients, carers, and staff and researched technologies based on common areas of need. Putting together the list of technologies, we found that no one technology suits the needs of *all* clients. Correspondingly, clients can use the list to select technology options to achieve their individual needs and goals.

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Executive Summary

The inability to live independently and care for oneself can affect the mental and emotional health of an individual (Ratzka, 2005). People enjoy being in control of their everyday actions and activities. For a person with a disability, it may be difficult to live independently within his or her home, causing them to feel stressed and unhappy. In light of this, the E.W. Tipping Foundation has begun to incorporate assistive technologies to help its clients with disabilities by improving their quality of life and independence within their homes.

The E.W. Tipping Foundation (EWTF) works together with its clients to help them meet their needs and goals (E.W. Tipping Foundation, 2015). Technologies can function as enablers; helping clients meet their needs and goals. Therefore, the goal of this project was to assist the EWTF in identifying technology options to assist its clients by improving the quality of life and independence within their homes. In order to achieve this goal, we completed the following objectives:

1. Determined where technology could be used to improve the lives of the clients
2. Researched appropriate technologies based on common needs amongst clients

To complete our first objective, we conducted a total of 14 interviews. We were able to interview eight EWTF staff, two carers, one occupational therapist, and three clients to learn more about their thoughts and experiences with assistive technologies. The EWTF staff provided us with information on the services they provide and their strategic plan for the upcoming years. Clients, carers, and the occupational therapist were able to help us understand common areas of need amongst clients and how technologies may assist them.

In working towards the second objective, we created a systematic research process for identifying such technologies. First, we looked for assistive technology suppliers. Then we analysed their technologies using five parameters -- cost, safety, ease of use, durability, and personalisation (Gitlin, 1995). When considering the purchase of a technology, these respective parameters should always be considered along with the specific functionality of the technology. This would ensure that the most appropriate technology option has been identified to assist a client.

Results

The interviews and research conducted resulted in the identification of five categories of technologies – home automation, health, computer access, information and communication, and security – that would benefit a wide range of clients. With the use of our systematic process, we found 86

technologies that can benefit a wide range of clients. These technologies were organised onto a dynamic list alongside information regarding their respective specifications and related parameters. Undoubtedly, this is only a small representation of technology options currently available. Moreover, due to the continuous developments of technologies, this list will need to be updated regularly.

Findings

Our research has been directed towards technologies that will help individuals with disabilities live independently. Through this research, **we found that technologies were not always specifically designed for people with disabilities.** Rather, technologies can be modified to assist a person with a disability. This expanded our research possibilities substantially.

As a result of our research, **we found that there is no "one size fits all" technology.** This is because the EWTF serves a wide range of individuals with many different disabilities. Clients with similar disabilities, such as autism, can have very different needs and goals. These needs and goals are based on what a client wants and how their disability affects them. Due to this, each client may need a different type of technology.

Throughout our research, **we found that there was a lack of consistency when researching the parameters -- cost, durability, safety, ease of use, personalisation.** This was because of the variation in the functionalities of the technologies researched. For some technologies, such as automated lighting, the parameters were easy to identify. However, other technologies, such as information and communication technologies, were much harder to quantify. This made comparing technologies difficult.

Recommendations

In order for the clients of the EWTF to benefit from the list of technologies, they should have a way to access it. Therefore, **we recommend that the EWTF make the list easily accessible and user-friendly for clients and carers.** This can be done through an online database that is accessible to all clients and by sending out a physical copy of the list in the "Tipping Talk" newsletter. These two methods will increase the amount of clients that may access the list.

We recommend that the EWTF assign a team of two or three staff members to the task of continuously updating the list. Some executive staff members believe that it will take more than one person to keep the list up to date, but no more than three. The two ways to continuously update the list are the technology supplier questionnaire and the systematic research process.

Future Work

Based on background research, we identified the five parameters that we believe should be taken into consideration when researching technologies – cost, ease of use, safety, durability, and

personalisation (Gitlin, 1995). **In the future, a project to assess these parameters of assistive technology should be taken into consideration.** This project would be important because it can further define the parameters, explain how they can be measured, and identify any other parameters that should be considered when researching assistive technology.

Another future project that can assist with finding parameters is to develop a rating system for the parameters. **The goal of a project like this would be to receive feedback from clients that are using technology and design a rating system based on this feedback.** Clients can then review the rating system when researching technologies for a specific need. This would help the EWTF find the best technology options that are available to their clients.

A project to create an app would be beneficial for the clients of the EWTF and assist them in accessing the list. **The goal of this project would be to create an easy to use and organised app of the list of technologies to improve its accessibility.** We have conducted research for the list and believe creating an app would be an easy way for clients to have access to the list. The app would allow any E.W. Tipping client or carer to access the full database of technologies. It can also help clients easily access any changes to the available technologies via app updates.

The goal of another potential future project would be to assess the process for updating the list. This would include an assessment of how often and efficiently the list is being updated. Additionally, the project could also aim to find new ways of updating the list that could be more efficient. Considering how often technologies are updated and further developed, the process by which the list is updated could also be improved upon. A more efficient process could save the EWTF time and resources.

Conclusion

A dynamic list of technologies was compiled as a result of our research and interviews. To assess the technologies on the list, we used specific parameters that were found to be important based on our background research. The EWTF can now provide its clients with this list of available technology options. This can help empower the clients and allow them to live independently. Furthermore, a list of technologies can attract new clients who could also benefit from such information and allow the Foundation to grow and expand as a stronger competitor in the industry.

Table of Contents

Table of Figures

Table of Tables

Chapter 1: Introduction

The inability to live independently and care for oneself can affect the mental and emotional health of an individual (Ratzka, 2005). People enjoy being in control of their everyday actions and activities. To maintain good mental and emotional health, it is important to pay attention to one's needs and feelings (Smith, Segal, & Segal, 2015). This includes managing stress levels while trying to maintain a balance between daily responsibilities and enjoyable activities (Smith, Segal, & Segal, 2015).

For a person with a disability, it may be difficult to live independently within his or her home. An individual with a disability may be unable to turn the lights on or off, open or close a door, access a computer, or receive information about their care plan. In such cases, disability service providers may assist their clients by providing a carer to help them with such tasks around the house and deliver periodic statements regarding their care plans. A family member may also assist the client in addition to the carer. However, when no one is available to help, a person with a disability may feel stressed due to his or her inability to live independently. In light of this, the E.W. Tipping Foundation has begun to incorporate assistive technologies to support its clients with disabilities by improving their quality of life and independence.

With a myriad of technologies available today, the E.W. Tipping Foundation had to identify what technology exists or could be modified to help its clients. The purpose of this project was to assist the E.W. Tipping Foundation in identifying technology options to help its clients by improving the quality of life and independence, especially in their own home. As a disability service provider, the Foundation focuses on delivering individualised care services for each client based on their needs and goals. Correspondingly, this project was focused on learning how disabilities affect individual clients and then assessing areas where technologies could benefit a wide range of clients. Thus, we created an updatable list of technology options that were identified using our research process, and further analysed how the list could be continuously updated and be available to clients, carers and other E.W. Tipping Foundation staff members.

The E.W. Tipping Foundation & Its Clients

The E.W. Tipping Foundation (EWTF) was founded in 1970 to continue the work of E.W. (Bill) Tipping, a prominent journalist in Melbourne and an advocate for people with disabilities (E.W. Tipping

Foundation, 2015). As a father of a son who had a disability, Mr. Tipping noticed the unacceptable conditions at the institution where his son resided. He believed that people with disabilities deserved better and with the help of the community around him created the EWTF. Mr. Tipping's philosophy of "working together" is still very much a part of the Foundation's core values (E.W. Tipping Foundation, 2015). The EWTF works together with its clients to help them meet their needs and goals (E.W. Tipping Foundation, 2015). Due to the fact that a disability affects each individual differently, the EWTF provides its clients with an individualised care plan. Personal carers assist clients according to clients' needs and goals. Technologies that would improve the quality of life and independence of clients would function as enablers; helping clients meet their needs and goals.

The EWTF serves many clients with a wide range of disabilities. The four most prominent disabilities amongst Australians are: physical disabilities, intellectual disabilities, acquired brain injuries, and autism. Physical disabilities relate to the total or partial loss of an individual's bodily functions (Physical Disability Council of NSW, n.d.). In Australia, around 3.4 million or 15% of individuals have some kind of physical disability (Australian Network on Disability, n.d.). Individuals with physical disabilities can have a variety of physical limitations. While some may have mobility restrictions others might have a difficult time hearing or seeing.

Intellectual disabilities, on the other hand, are characterised by a cognitive impairment that makes it difficult to perform day-to-day activities (WebMD, 2013). They affect the way a person acts socially, emotionally, and cognitively (WebMD, 2013). This form of a disability typically occurs due to damage or interference with brain development. For instance, some children are born with an extra chromosome, typically leading to Down syndrome. According to the Australian Bureau of Statistics (2012), approximately 668,100 or 2.9% of Australians have an intellectual disability. A 2012 Australian study showed that 62% of people with intellectual disabilities had severe limitations and needed help with mobility, self-care, and communication (Australian Bureau of Statistics, 2014). The most common activity where assistance is needed is during cognitive or emotional tasks, such as being able to pay attention and using logic and reasoning to assist them in making decisions.

Acquired brain injury, or ABI, consists of any damage to the brain that was not present at birth (The Rehab Group, 2015). In Australia, over 600,000 people have an ABI, and about two thirds of those people acquire their injury before the age of 25 (Brain Injury Australia, n.d.). An ABI can be categorised into two main groups, traumatic and non-traumatic brain injuries. Traumatic brain injuries occur when an individual takes a large force to the head during a traumatic event. For example, some brain injuries can occur from a hard hit to the head in a sport like Rugby or Australian Rules football (Gaines, 2014). Non-traumatic brain injuries occur when the individual encounters a non-violent case, such as a stroke, brain

tumour, or drug and alcohol abuse (The Rehab Group, 2015). A person could also endure two types of changes associated with ABI – cognitive and physical change. Cognitive changes affect the way an individual learns and perceives the world around them. There are cases where cognitive change does not worsen over time. However, there are also cases where cognitive change can get worse as time goes on, such as memory loss and depression (The Rehab Group, 2015). Physical changes, such as paralysis and lack of balance, are physically present and are often hard for the individual to overcome (Synapse, n.d.).

Lastly, autism is a lifelong developmental disability that affects social interaction, communication, behaviours, and sensory sensitivities in about 1 in 100 Australians (Autism Spectrum, 2015). The autism spectrum is used to reflect the wide range of challenges that people with autism may experience. Autism can be categorised into three specific areas: behavioural, social interaction, and communication (Autism Spectrum, 2015). Autism can prevent an individual from recognising social signs, such as facial expressions, physical gestures, or eye contact (Autism Spectrum, 2015). They may have a difficult time communicating their own needs, and likewise, may not understand the needs of others. Thus, they could fall back on repetitive behaviours and avoid interacting with other people (Autism Spectrum, 2015).

While there are several different common disabilities, each client has different specific needs. The EWTF tries to meet the needs of its clients regardless of the type of disability and other limitations they may experience. In particular, the goal of the EWTF is to help its clients live more independently within and outside of their homes. Assistive technologies could be a good way to help clients and provide them with more independence.

The Role of Assistive Technology

Assistive technology is: "Any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified or customised, that is used to increase, maintain, or improve functional capacities of individuals with disabilities" (SCATP, 2013). Assistive technologies help individuals with disabilities fully engage in life's activities, and improve functional independence by providing ways for them to accomplish everyday tasks (CDC, 2014). By this definition, any technology that helps a person with a disability is considered an assistive technology.

Important Considerations for Assistive Technology

When considering a technology, it is important to consider not just its functionality but its cost, ease of use, safety, durability, and personalisation as well (Gitlin, 1995). This is because, in order for a particular technology to be useful, clients must be able to rely on the service it provides (Dewsbury, Rouncefield, Clarke, & Sommerville, 2002). As a result, when considering the purchase of a technology, especially an assistive technology, these respective parameters should always be considered in addition to the specific functionality of the technology.

One of the most important parameters when considering technology is its cost. The best technology options may not always turn out to be the most cost effective (Dewsbury, Rouncefield, Clarke, & Sommerville, 2002). Due to the fact that the EWTF and its clients have limited funding, the cost of any technology will be an ultimate deciding factor. For this reason, cost and the benefits of technologies need to be examined carefully.

Safety is another important parameter when considering assistive technologies. Some individuals with disabilities have limitations that would prevent them from using certain technologies. For example, a client may have very sensitive skin, and consequently may not be able to use technology devices that are abrasive to the skin. Also, safety should be considered in terms of privacy, especially during the uploading, storing, and downloading of confidential information. If clients are using software to upload and store medical history information, the software should include features that would protect that information; such as firewalls to defend against hackers and any other unauthorised access.

Ease of use is another important parameter. Technologies that are stand-alone items are usually easy to use, such as a device that calls for help when activated (SCATP, 2013). However, most technologies are more complex and have multiple components, making them difficult to use. One of the main reasons people abandon a technology is the lack of knowledge on its setup and use (Gitlin, 1995). In other words, if it is too complicated to use or install, the person might be unwilling to learn about it, or may have to rely on a carer to help them use it at an increased cost.

Durability is another one of the main considerations that should be made when selecting technology. People often abandon technology use because of device failure (Gitlin, 1995). A successful technology must be able to withstand some damage and should have a long life span. This is important because if a device fails or does not last it will be unable to assist an individual. Similarly, if the battery needs to be changed or charged too often, it can be a nuisance to the client.

Lastly, disabilities affect each individual differently. For this reason, the ability to personalise a technology to fit the preferences and needs of an individual is of importance. Clients will use technology for different reasons based on the nature of their disability. While one person may enjoy using his or her tablet to simply browse the web, others may need it to run company programs and communicate with work colleagues. The most effective technologies can be personalised from person to person and be able to adjust to these individual needs (SCATP, 2013).

In summary, having the ability to live independently by using technology can improve the mental and emotional health of people with disabilities (Ratzka, 2005). The EWTF provides services to individuals with different disabilities, each of which have individual needs. Using the five parameters we have identified, we aimed to empower individuals with disabilities by providing them with a wide range of technology options that can improve their independence while living in their homes. To do this, we created a systematic research process, which we used to develop a list of assistive technologies.

Chapter 2: Methodology

The goal of this project was to create an updatable list that identifies a wide range of assistive technology options for the clients and staff of the EWTF, which could increase the quality of life and independence of clients. In order to achieve this goal, we completed the following objectives:

1. Determined where technology could be used to improve the lives of a wide range of clients
2. Researched appropriate technologies based on common needs amongst clients

Determine Where Technology Could Be Used to Improve the Lives of the Clients

Participants

A total of 14 people participated in the interviews. Altogether there were three clients, two carers, one occupational therapist, and eight EWTF staff members. All participants gave informed consent prior to starting the interview. After each interview, all participants provided post-interview consent that the information they provided could be used for data analysis and the report. Nine of the participants agreed to be audio recorded.

Measures and Procedure

We conducted 30-minute interviews with EWTF staff members, clients, carers, and an occupational therapist to discuss their thoughts and experiences with assistive technologies. To begin our interviews we first introduced ourselves and explained the project and purpose of the interview. Then, we reviewed the informed consent forms with participants and each interviewee provided their consent. The same process was followed using an audio recording consent form for nine interviews that were audio recorded. After gaining informed consent, we began each interview.

A semi-structured interview method was used to interview EWTF staff. Interviews with EWTF staff members were meant to learn about their role at the EWTF, how the Foundation operates, how care is provided to clients, and how assistive technologies are incorporated into that care. Using a semi-structured approach allowed us to ask additional follow-up questions with respect to participants' responses to our initial set of questions. Our initial questions included: What is your role at the EWTF,

and how does it relate to clients? Are you aware of existing assistive technologies? What specifications do you feel are important in technology? A complete list of questions can be found in Appendix A.

We also interviewed clients of the EWTF. Due to the sensitive nature of our project, it was very important for us to ensure that we conducted interviews with clients in a respectful manner and in a way that they would best understand what we were asking. After speaking with professionals who had experience working with people with disabilities, we decided to interview clients using a motivational interview method. A motivational interview is a conversational style of interviewing that is collaborative and evocative (College of Pharmacists of Manitoba, n.d.). Since it was more of a conversation rather than a structured interview, it allowed clients to reveal only the information they felt comfortable sharing. Additionally, to ensure that our questions were worded and asked in a way that was respectful and understood by clients, we reviewed our intended interview questions with staff members from the Client Outcomes and Service Improvement department at the EWTF.

To begin a client interview, we introduced ourselves and then asked the clients to tell us more about themselves. After introductions, we discussed general topics to engage the clients in simple conversation, such as sports, music, the beautiful scenery in Australia, etc. Then, we guided the conversation towards the daily activities of clients to gain a better understanding of how their disability affects them. Through such conversations we were also able to obtain a sense of how the clients felt about using technology in general, and asked them about any technologies that they are currently using or may have used in the past. Similarly, we guided the conversations towards questions like: what daily tasks do you need support to accomplish? Have you tried using anything to help you with these? If you knew technologies to help were available, would you be likely to use them? This allowed us to further identify areas where technology can benefit a client. A complete list of questions can be found in Appendix B.

During the beginning portion of the client interviews, we asked them if they would like a carer or family member present during the interview. This served several purposes. First, carers and family members were able to provide support and motivation. Additionally, we recognised that the nature of a client's disability may make communication difficult. In these cases, the carers knew the best way to communicate with the clients and were able to assist us during the interview. In total, a carer was present during two of our three client interviews. Furthermore, we wanted to learn more about the clients' needs from the carers' perspective, and if there were any ways that technology might also help the carers when providing services to the clients. To do so, we asked carers questions such as "what ways can you see technology being useful to enhance the services your client receives?" A list of questions for carers can be found in Appendix C.

In addition to speaking with clients, carers, and the EWTF staff, we contacted an occupational therapy office. We were able to speak with an occupational therapist that works with clients with disabilities and uses assistive technologies. This occupational therapist was able to provide us with information regarding the work and common areas where clients require assistance. Moreover, we also discussed the assistive technologies that this occupational therapist has worked with in the past and what the experience of using those technologies was like for the clients.

The interviews we conducted allowed us to focus our research of technologies in areas of need that are most prevalent amongst EWTF clients. Staff members were able to help us understand what services the EWTF currently provides. Likewise, we were able understand what clients look for in an assistive technology. These interviews, in turn, helped us identify technologies for clients.

Appropriate Technologies Based on Common Needs of Clients

Based on the interviews, we were able to determine where technology could improve the quality of life of the clients. Using that information, we were able to research different technology options that can assist a wide range of clients. To compare technologies with the same functionality and determine what would work best for a client, we used the aforementioned parameters – cost, durability, personalisation, safety, and ease of use (Gitlin, 1995). Clients would also be able to use this information to decide if a technology option suits their needs.

Chapter 3: Results

Through the interviews conducted with the EWTF staff, carers, clients, and an occupational therapist, we learned about the services the EWTF provides its clients and how they do so. Additionally, we have determined five areas where clients can benefit from the use of technology. These include:

- Home Automation
- Information and Communication Technology
- Health
- Computer Access
- Security

Within these areas, we have identified specific tasks that technology may help with. For example, turning lights on and off can be a need categorised under home automation. Using this information, and a research process that we developed for finding assistive technologies, we have created a list of technologies available to assist the EWTF clients.

E.W. Tipping Services

Our interviews revealed that the EWTF provides many valuable services to its clients. In one interview with an EWTF manager, we asked about how the EWTF operates. We were told about the strategic plan that the EWTF has implemented. The first step of the strategic plan is about their services. The EWTF takes a client-first approach, and as such the client is the one who decides what services they want. Thus, the EWTF creates sustainable and client-led services that are personalised for each individual. The next step is about the people they work with. The EWTF provides much training to its staff, and delivers arrangements the organization believe are beneficial for all people involved. Third, the strategic plan talks about the importance of relationships. By continuously keeping open communication between clients, carers, staff, and external operations, the Foundation is able to make informed decisions and keep relationships strong. The last part of the strategic plan is about resources. The EWTF does their best to provide services to all clients by using its resources wisely, and are continuously finding ways to increase future growth and efficiency.

An interview with a different manager at the EWTF gave us an understanding of how the Foundation interacts and communicates with its clients. The carers are able to communicate with all

clients by using Easy English. This involves a series of very simple statements with accompanying pictures, allowing for effective communication with clients who have cognitive impairments. Additionally, this manager told us about how individualised the care plans are for clients. Many of the EWTF clients have very different needs, each of which the Foundation tries to address. Furthermore, they have to ensure they do not provide unnecessary care for clients, as it makes the clients feel marginalised because they are receiving care that they feel is not needed.

An interview with an executive member of the EWTF staff discussed the competitive environment for disability service providers and where the Foundation is heading in the future. The EWTF provides services to clients in many regional areas within the state of Victoria, which makes them unique. The EWTF attempts to provide the best care for their clients by providing individualised care plans. As the industry moves towards giving more control to the clients, this executive believes that providing clients with assistive technology options will enable clients to make more informed decisions.

Systematic Research Process

In order to simplify the researching of assistive technologies, we have developed a systematic research process. A flow chart of this process can be seen in Figure 1. First, there must be a need for a piece of technology, which can be identified by a trained EWTF staff member. People with disabilities often know what they need, and their carers are trained to determine the needs of the individual. Once this need is determined, the list of technologies should be looked through to see if there are any that match the need.

Once an individual need of a client is determined, the list can be looked through for technology that helps with that need. If technologies were found, the client can look at the specifications of each and pick the technology that best fits them as an individual. Then, a researcher should make sure that the technology picked is the latest version or model, and update the list if a newer one was found. If the technology is not on the list, then the process lays out a plan for how to find that technology.

First, the researcher can look at the list of technology suppliers and choose the one they believe best fits the client. Then, they can contact that supplier or look on their website to determine if they sell the technology that they are looking for. If the supplier does have it, then the researcher can research its parameters and specifications, and compare them to other technologies that they found. Otherwise, the researcher should look for a different technology supplier. In the end, the researcher must determine which technology they found would best fit the client. The researcher can then inform the client and carer

of what they found, and update the list with the correct specifications so future clients and carers are kept up to date with technology that is available to them.

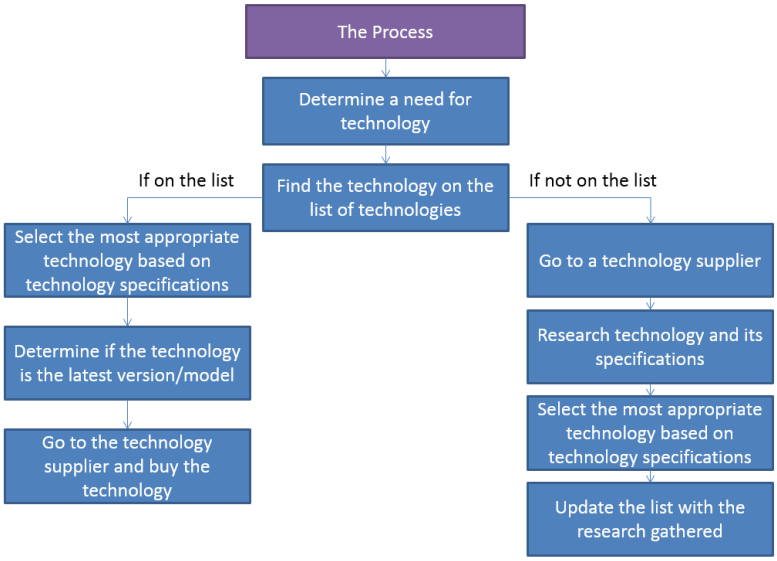


Figure 1: Systematic Research Process

Determine the Needs of Clients

The first step in our research process was to understand how the organisation defines client needs. John McKenna, a former EWTF Board Member and a current employee who works in the Client Services Department, lives with a disability that he has had since birth. As a person who has lived with a disability, he understands the importance of technology and how it can improve quality of life. John spoke about how his remote door opener made him feel empowered because he was able to decide who enters his home just by pushing a button. He stated that, "it is about empowerment and what piece of technology is going to make that person feel valued. If you are feeling valued, it is because you're achieving something or making a difference in society" (John McKenna, personal communication). According to Mr. McKenna, all clients have individual needs and goals that they would like to meet, usually something they would like to do independently. Assistive technologies can help clients achieve their goal and meet their independent needs. [1]

To find certain areas of common need, we have interviewed clients, carers, and an occupational therapist. These areas of common need, along with their respective category, can be seen in Table 1.

Although there may be more areas that apply to individual clients, these are needs we have identified through our research to be common across a wide range of clients.

Table 1: Common Areas of Need

Category	Common Areas of Need
Home Automation	Turning Lights On and Off
Home Automation	Dimming Lights
Home Automation	Climate Control
Home Automation	Opening and Closing Windows
Information and Communication	Communication Aids
Information and Communication	Rostering*
Health	Health Management
Computer Access	Using a Mouse
Computer Access	Using a Keyboard
Computer Access	Reading the Computer Screen
Security	Locking and Unlocking Doors
Security	Home Security
Security	GPS Location

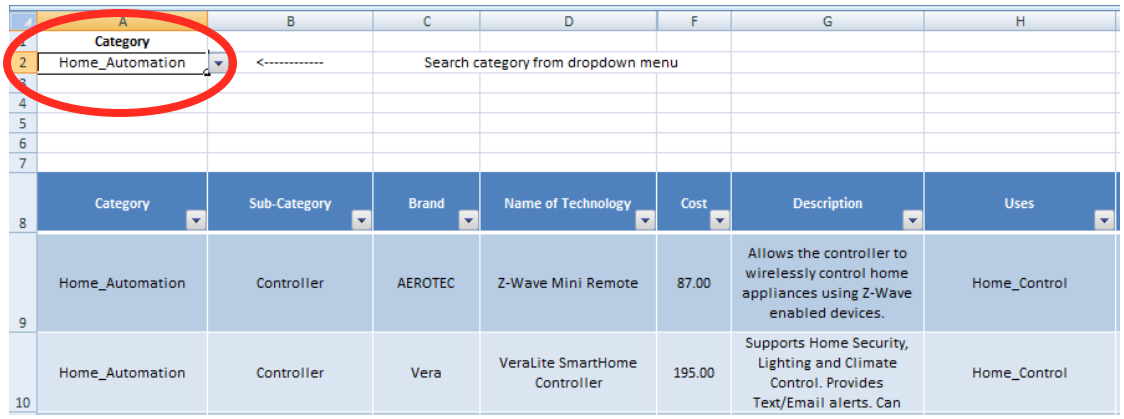
*for staff and clients

[1] Mr. McKenna gave informed written and oral consent for his name to be used and he approved this paragraph for use

List of Technologies to Benefit Clients of the EWTF

Using the technologies we have researched based on the common areas of need, we created lists of technologies for each of our categories: home automation, information and communication technology, health, computer access, and security. We chose these categories based on the information we received during interviews with several EWTF staff members and an occupational therapist. In each list, we have broken up technologies into further subsections for easier navigation. For example, in the computer access list, we have sub-categories of alternative keyboards, alternative mouses, and alternative output.

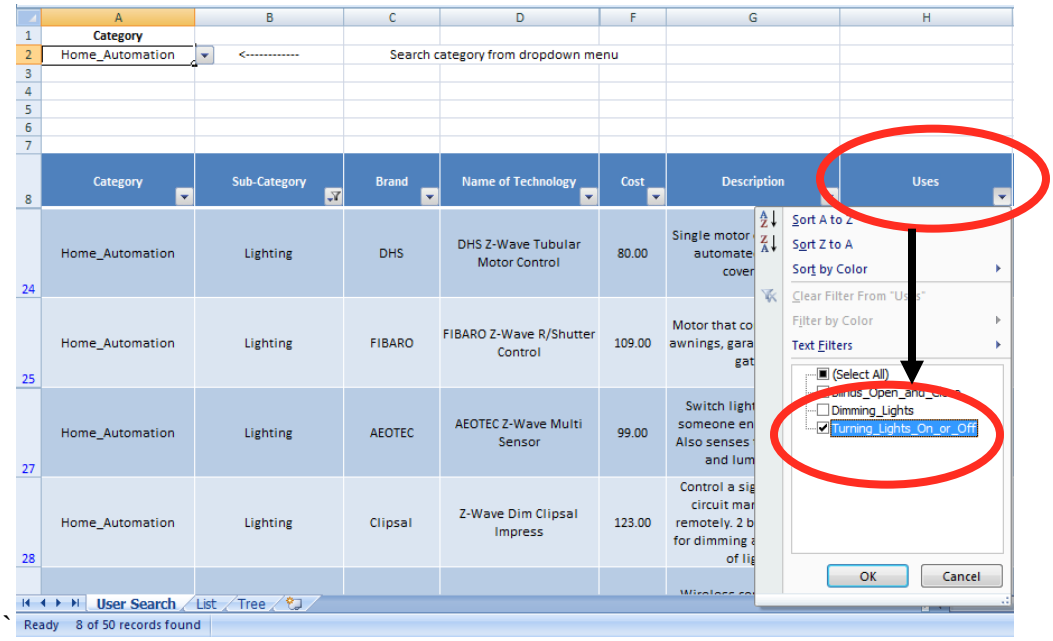
The list was created on Microsoft Excel, which is included with the submission of this report. Navigation of the list of technologies was a very important consideration, as it directly affects how easy it is to find specific technologies. Therefore, we created a system for filtering the list. Using dropdown menus, the user can filter the list based on category, sub-category and use. For example, if a user was looking for lighting controls, specifically, they select 'home automation' as the category. This can be seen in Figure 2.



	A	B	C	D	F	G	H
1	Category						
2	Home_Automation	<----------	Search category from dropdown menu				
8	Category	Sub-Category	Brand	Name of Technology	Cost	Description	Uses
9	Home_Automation	Controller	AEROTEC	Z-Wave Mini Remote	87.00	Allows the controller to wirelessly control home appliances using Z-Wave enabled devices.	Home_Control
10	Home_Automation	Controller	Vera	VeraLite SmartHome Controller	195.00	Supports Home Security, Lighting and Climate Control. Provides Text/Email alerts. Can	Home_Control

Figure 2: Search by Category

The list can then be filtered using the dropdown menus in the headings of the list to find 'lighting' as the sub-category, and 'turning lights on or off' as the use. Figure 3 shows how this would be done.



	A	B	C	D	F	G	H
1	Category						
2	Home_Automation	<----------	Search category from dropdown menu				
8	Category	Sub-Category	Brand	Name of Technology	Cost	Description	Uses
24	Home_Automation	Lighting	DHS	DHS Z-Wave Tubular Motor Control	80.00	Single motor automate cover	
25	Home_Automation	Lighting	FIBARO	FIBARO Z-Wave R/Shutter Control	109.00	Motor that co awnings, gara gat	
27	Home_Automation	Lighting	AEOTEC	AEOTEC Z-Wave Multi Sensor	99.00	Switch ligh someone en Also senses and lum	
28	Home_Automation	Lighting	Clipsal	Z-Wave Dim Clipsal Impress	123.00	Control a sig circuit mar remotely. 2 b for dimming of lig	

Figure 3: Search by Sub-Category or Use

With each technology added to the list, we have several pieces of information that were added to describe the technology. These included one column for each parameter, where we provide information on the parameter, if any could be found. Additionally, we included (when applicable) the brand of the technology, name of the technology, picture, cost, a brief description, the uses, any system requirements, supplier information, and a link to the webpage for more information on technology specifications. The cost, if originally in American Dollars, was converted to Australian Dollars with a 0.78 conversion rate.

Home Automation Technology

As human and computer interaction grows, assistive technologies are also becoming more advanced (Kouba & Newberry). A long-term focus of assistive technology research is to create fully automated "smart homes". These are homes that can monitor people as they go about their day, and assist the resident accordingly. Currently available home automation consists of a remote that can control

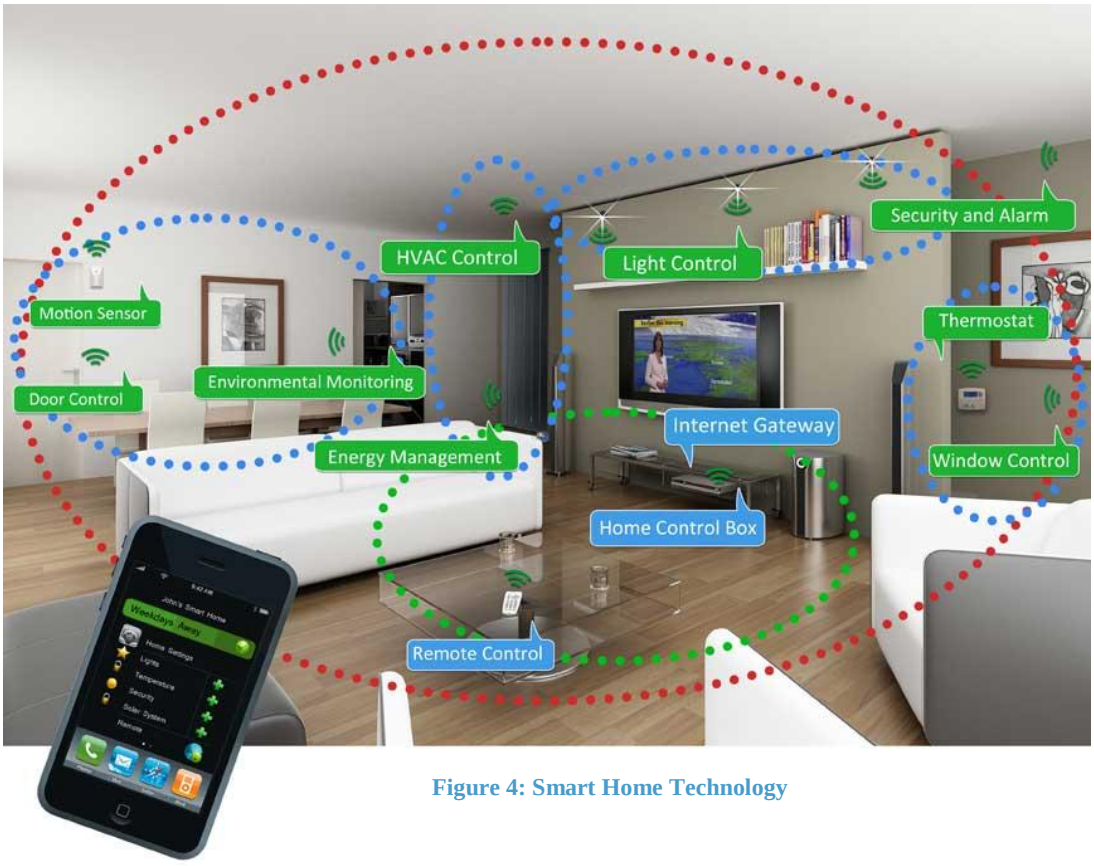


Figure 4: Smart Home Technology

various features of the home (Middy's Technologies, 2015). Figure 4 shows a smart home where various features, such as doors, lighting, windows, and heating, can be controlled by a remote app on a smartphone.

Currently, the deployment of assistive technology in these smart homes is very expensive. This is because the technology to monitor the residents and react to their needs is complex. However, home automation as assistive technology is rapidly growing. As home automation technologies advance, they become more user-friendly and could become less expensive (Kouba & Newberry). Additionally, there exist smaller scale home automation devices that are much less expensive, but provide only specific home automation features.

When looking at home automation, there are a number of different ways that devices can be connected to each other. Wired connections can be useful in houses, but can be difficult to implement because they are expensive to install into existing homes. Therefore, some companies working on home automation features are using wireless technology because it can be implemented into a home more easily and is less expensive. When used properly, both wired and wireless techniques can be very effective for home automation.

Wireless Protocols

Z-Wave is a wireless protocol that uses radio frequency (921.42 MHz in Australia and New Zealand) to remotely control electronic devices around a house (Z-Wave, 2015). It is based around a central home controller that receives information from the networked devices regarding their states. One can remotely change the state of a device in a system that uses the Z-Wave protocol from on to off through an application on a smartphone or tablet. For home automation, devices that run on the Z-Wave protocol can span over a wide range of areas within the home, such as lighting, climate control, and security (Z-Wave, 2015). There are a multitude of brands of technologies that also work on the Z-Wave protocol, giving many options to choose from. For example, all products made by Honeywell, Kwikset, and Leviton are all capable of working within the Z-Wave protocol.

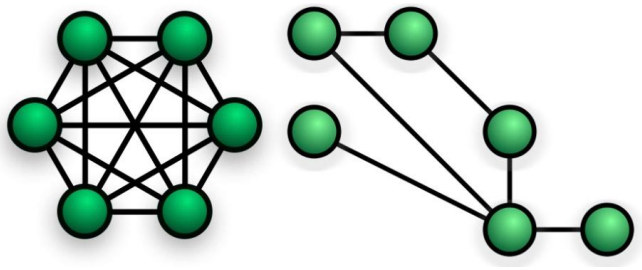


Figure 5: Example of Mesh Networking

For communicating, Z-Wave protocol uses a networking technique called mesh networking. Instead of devices on a network communicating through one centralised location, mesh networking allows devices to communicate with other devices in the same network. For example, when an individual uses his or her smartphone to send a command to unlock the front door, the message sent from the phone is not routed to

the centralised system. Rather, it can travel directly to the device that opens the door through paths created by other devices in the system. There can be more than one path that a message can take to reach a device, which increases the reliability of the network. The more devices there are on the network, the more paths a signal can take to get to a device. The increase in devices also allows the range of the network to expand (Z-Wave, 2015). The concept of mesh networking is also very low power, which extends the battery life of devices in the network (Prindle, 2014).

Much like Z-Wave, ZigBee is both a wireless protocol used in home automation systems as well as a manufacturer for products that work on that protocol. However, ZigBee uses the standard-based 802.15.4 wireless communication standard that was built by the Institute of Electrical and Electronics Engineers, or the IEEE (ZigBee Alliance, 2015). This means that the devices built by ZigBee can be used internationally.

INSTEON is home automation technology that uses dual mesh networking for device communication (INSTEON, n.d.). In other words, it uses both wired and wireless communication to converse with its products. The wired connection is utilised over the power lines that power the home while the wireless communication is done over radio frequency, or RF (INSTEON, n.d.). When a signal is sent through a dual mesh network, it is sent over both the wireless and the wired systems. This increases the reliability of the entire system. If the wireless fails, the wired network will still be able to deliver the message to the receiving device.

By bridging the gap between wired and wireless, INSTEON works well with homes that may have existing wired home automation systems, such as X10 (Prindle, 2014). INSTEON can take the wired network that was previously in use and add a wireless network to it while still keeping the same devices on the wired network. For example, if there was a previous wired home automation system installed into a home, a new home automation system would not be needed. This means that INSTEON has a wide range of devices that work well on the dual mesh networking system (INSTEON, n.d.).

Lighting

Many of the clients we interviewed discussed the difficulty they had controlling the lighting within their current home. Clients described how they were unable to control the lights in certain rooms, especially when they were left home alone at night. They also talked about not having the ability to open or close their blinds or curtains during the day. Technology exists that will allow individuals to control their lighting throughout their home using a tablet or smartphone.

Philips Hue Light Bulb

Table 2: Philips Hue Light Bulb Parameters

Name: Philips Hue Light Bulb	Information
Cost	AU$250 for a 'Starterpack', AU$70
Durability	Bulbs last for up to 15,000 hours
Safety	None specified
Ease of Use	Can fit into any standardised Edison light bulb socket
Personalisation	Change colours of lights, set schedules

Figure 6: Philips Hue Light Bulb 'Starterpack'

Philips has developed a smart light bulb called Hue (Philips, 2015). This light bulb can be controlled through a number of different apps on a smartphone or tablet. These apps can control anything from the colour of the lights, their brightness, and simply turning them on and off. These bulbs utilise light emitting diodes (LEDs) and have a life expectancy of up to 15,000 hours (Philips, 2015). They are easily installed as they are screwed into any standard Edison light bulb socket. In order for the light bulbs and the smartphone or tablet to communicate, a device called a 'bridge' is connected to pass the commands from the smartphone or tablet to the light bulb. A 'starterpack' that includes three Hue light bulbs and the bridge that connects the devices, can be purchased for AU$250. Purchasing a single subsequent light bulb would cost approximately AU$70 (Philips, 2015).

DHS Z-Wave Tubular Motor Control

Table 3: DHS Z-Wave Tubular Motor Control Parameters

Name: DHS Z-Wave Tubular Motor Control	Information
Cost	AU$80
Durability	Not specified
Safety	Not specified
Ease of Use	Push a button on a Z-Wave remote
personalisation	Customise percentage of shade level

To control curtains or blinds, DHS has developed a motor that attaches to curtains or blinds and works to open, close, or tilt them to a certain angle (Z-Wave Home Automation Australia, 2015). The motor can be purchased for AU$80 (Z-Wave Home Automation Australia, 2015). It is supported through the Z-Wave wireless protocol, which means that it will work with any Z-Wave

Figure 7: DHS Z-Wave Tubular Motor Control

home controller. The prices of the Z-Wave home controllers vary from AU$200 to AU$1,500 depending on the features that the controller has. A Z-Wave remote can be purchased for around AU$90 to control the device.

Climate

Clients we spoke to addressed not having the ability to control the temperature and environment around them. Automated temperature control can not only help heat or cool a home at distinct times, but it can also assist in saving money by being energy efficient. A client can use his or her smartphone or tablet to control the temperature in their home or open their windows.

Nest Learning Thermostat

Table 4: Nest Learning Thermostat Parameters

Name: Nest Learning Thermostat	**Information**
Cost	AU$322
Durability	Two year limited warranty
Safety	Government graded encryption (128-bit)
Ease of Use	Device learns user temperature preferences within three weeks. App on smartphone or tablet to control
Personalisation	Set temperature preferences and schedules based on your daily life

Figure 8: Nest Learning Thermostat

In a week's time, the Nest Learning Thermostat can automatically adjust to preferred home temperatures throughout the day (Nest, 2015). The product is secured with the same technology that protects classified government documents and comes with a two year limited warranty. Although the initial cost is AU$322, it can save energy and money by turning itself off when there is no one home. It can be controlled manually or remotely through an app on a smartphone or tablet via Wi-Fi (Nest, 2015).

DHS Z-Wave With Chain Winder

Table 5: DHS Z-Wave With Chain Winder Parameters

Name: DHS Z-Wave With Chain Winder	Information
Cost	AU$359
Durability	Not specified
Safety	Electronically defined pressing force to keep window secure when closed
Ease of Use	Button on a Z-Wave Remote
personalisation	Not specified

Figure 9: DHS Z-Wave With Chain Winder

This product has the ability to open and close windows that an individual is unable to reach. This can assist in maintaining a comfortable climate within a home. It uses a motorised winder that is attached to the window to remotely open and close it (Z-Wave Home Automation Australia, 2015). The device uses an electronically defined pressing force to keep the window secure when it is closed. It uses the Z-Wave protocol and can be controlled through the use of a remote within a Z-Wave protocol system. The chain winder can be purchased for AU$359 (Z-Wave Home Automation Australia, 2015).

Information and Communication Technologies

Information and communications technologies (ICT) are hardware and software that enable data to be digitally processed, stored, and communicated (AusVELS, 2015). These technologies include online portals for sharing and storing information, financial management tools, video conferencing, social media, and other everyday technologies. Such technologies would benefit both the staff and the clients of the EWTF by improving the way information is transferred, delivered, and communicated between administration, staff, and clients.

Information Technology

Carelink+ Online

Table 6: Carelink+ Online Parameters

Name: Carelink+ Online	Information
Cost	Priced for Organisations
Durability	N/A
Safety	N/A
Ease of Use	Not Specified
Personalisation	Not Specified

Carelink+ is a suite of software solutions designed specifically for Australian Community Care organisations (Iconglobal, 2013). As a system, Carelink+ allows organisations like the EWTF to manage and access employee rosters, client medical history, payroll, client budgets, and other administrative functions. In an effort to provide more control to clients, a client portal has recently been added to the Carelink+ suite of solutions as part of the Carelink+ Online (Iconglobal, 2013). Through this client portal, clients would be able to receive real time information regarding their budgets, print statements, roster and scheduling information, carer and staff contact details, and request further information.

Figure 10: Carelink+ Online

The Carelink+ Online software, which includes the client portal as well as an employee portal, could simply be added to EWTF's existing Carelink+ system. Icon Global, developer of Carelink+, would give a pricing estimate to the EWTF based on the number of licenses and additional features the Foundation needs. According to EWTF staff, with some training, the software is easy to learn and use. Furthermore, using technologies such as this would allow clients more access to manage their own care.

Communication Aids

Tools2Talk

Table 7: Tools2Talk Parameters

Name: Tools2Talk	Information
Cost	AU$14.99
Durability	N/A
Safety	N/A
Ease of Use	Not Specified
Personalisation	Create communication tools using photo album. Share, print, store communication aids.

Figure 11: Tools2Talk

Tools2Talk was developed with the help of speech pathologists working with Scope, a Victorian disability service provider (Scope, 2014). Tools2Talk is a template app that allows a user to create communication aids using pictures, symbols, and text. These communication aid templates can then be printed, emailed, or stored in any device in many different formats to be used when communicating with others.

Having been developed by a disability service provider alongside speech pathologists, this app has been created with the intent of being easy to use (Scope, 2014). Users can personalise their communication aid templates by adding photos from their own album. Unfortunately, the app is only available specifically for the iPad. Therefore, only users who own an iPad would be able to get this app.

Out & About App

Table 8: Out & About Parameters

Name: Out & About	Information
Cost	Free
Durability	N/A
Safety	N/A
Ease of Use	Not Specified
Personalisation	Users can add venues that are accessible and plan their route accordingly using Google Maps.

A concern we found with a few of the EWTF clients was getting out of their homes. Whether out in the city to visit friends or family, or out to visit their care provider, some clients were concerned with accessibility on public transportation, venues, and other establishments. With the Out & About app, users are able to plan their routes on public transport knowing that the public transportation along their route is accessible to fit their needs. The app also notifies users if the area they are visiting has handrail support, accessible toilets, accessible parking, and other accessibilities.

This app is available for Android and iOS based smartphones and tablets for free. Having been developed with the help of Villa Maria, a disability service provider, it has been created to be easy to use for people with disabilities (Villa Maria, n.d.). Users must use a smartphone or tablet connected to either Wi-Fi or data to use this app. Nonetheless, it would be extremely useful for people with disabilities when planning a trip into the city or anywhere else. Additionally, users could add venues they have visited that are accessible to people with disabilities and rate their accessibility.

Health Technologies

Health and medical technologies are important tools for people with disabilities who want to live independently. This is because they will not have people with them at all times to help them take care of themselves, or help them in case of an emergency. These technologies can include reminders to take medications, easy to activate emergency contact devices, and fall detectors that are worn on the body.

Medication Reminder

RxmindMe Prescription/Medication Reminder and Pill Tracker

Table 9: RxmindMe Parameters

Name: RxmindMe	**Description**
Cost	Free
Durability	N/A
Safety	N/A
Ease of Use	Built in tutorial, may be difficult to add new meds
Personalisation	Adding new medications at specified times

Figure 12: Rxmind Me

RxmindMe is a simple app that can be a very useful tool to remember when to take medication and keep track of what has been already taken. Many people with disabilities require multiple medications to be taken on a regular basis. This fact, combined with any cognitive or memory limitations the client may have, can cause difficulty in taking medication as scheduled (Aungst, 2012). This app allows all medications to be entered by the client or by a carer. Then, whenever the clients need to take a medication, they will be reminded to do so.

The RxmindMe app can be very useful for people with disabilities for a number of reasons. First, it is very simple and easy to learn. There is a straight-forward tutorial built into the app that can teach the client how to use it. Additionally, if a carer adds the medications that should be taken, all the client needs to do is respond to each notification as they come up. Also, this app allows data to be exported and emailed to carers to show the medications that were taken, and if any medications were missed (Aungst, 2012). This helps the client maintain a regular schedule of taking their medications. Lastly, the app is completely free, which is important for many people with disabilities who have a very limited budget. Overall, the RxmindMe app provides a simple and free way to remind clients to take medications as prescribed.

CareAlert Smart Dialler

Table 10: CareAlert Smart Dialler

Name: CareAlert Smart Dialler	Description
Cost	AU$289
Durability	Battery backup in case of power failure, waterproof
Safety	Dual pressure point minimises accidental triggers, passes all necessary Australian standards
Ease of Use	Simply press both buttons to activate
Personalisation	Hols up to 5 personalised numbers, can operate silently or in alarm mode,

The CareAlert Smart Dialler is an emergency call device that can be worn either as a pendant or wrist strap. It has two large, easy to activate buttons that, when pressed, calls a series of five programmable numbers in order and leaves a pre-recorded help message, making the device personalised. It also has a two-way communication capability, allowing the user to talk to the person who is called.

Figure 13: CareAlert Smart Dialler

This device satisfies a number of different criteria that make it a suitable technology for many people with disabilities. First, it is very user friendly and easy to use. After the initial setup, all that needs to be done is to press two buttons, and help can be on the way. In addition, the device is very durable. It is water-resistant, which allows it to be worn at all times, and also includes a battery backup in case of power failure. Lastly, the device has an initial cost of AU$289, and no ongoing cost. Many services that are similar to this product have fees over time, making the CareAlert Smart Dialler the less expensive option if used over a period of time.

Computer Access Aids

Disabilities often affect an individual's ability to use a computer. Physical disabilities can prevent people from using the standard input devices, such as a mouse and keyboard. Additionally, impaired vision and hearing can render the standard monitor and speaker output of a computer useless. However, access to a computer and the internet can provide a great deal of independence for many people with sensory, physical, and learning disabilities (Disabled World, n.d.). There are a multitude of computer access aids available to help people with varying disabilities. These consist of both alternative input and alternative output. Alternative inputs involve altered mouses and keyboards, or other devices that can act as a mouse or keyboard for those that cannot use the standard ones. Alternative outputs involve hardware

or software that can help people with sensory limitations know what the computer is displaying. For most people, a variety of software and hardware devices can be used to provide access to computers and the internet.

Using a Mouse

BIGtrack Trackball

Table 11: BIGtrack Trackball Parameters

Name: BIGtrack Trackball	Information
Cost	AU$127.20
Durability	Not specified
Safety	Not specified
Ease of Use	Oversized buttons, automatic installation, drag-lock
Personalisation	Switch adaptable, optional 2nd mouse connection

Many people with disabilities are unable to use a standard mouse due to physical or other impairments. Fortunately, alternative mouses exist to aid people with mild to severe disabilities. Those with limited control of their hands, for example, can use either a trackball or joystick. These are often easier for a person with motor impairments to control (WebAIM, 2015). The BIGtrack Trackball is one trackball mouse that works on both PC and Mac. It costs AU$127.20, which is relatively inexpensive compared to other similar devices. Additionally, it provides accurate mouse movements for people with poor control of their hands.

Figure 14: BIGtrack Trackball

QUHA ZONO Gyroscopic Mouse

Table 12: QUHA ZONO Gyroscopic Mouse Parameters

Name: QUHA ZONO Gyroscopic Mouse	Information
Cost	AU$1,165
Durability	30 hour battery life
Safety	Not specified
Ease of Use	User manual and instructional CD included
Personalisation	Can be worn with headband, head mount, eyewear, or hat

There are also technologies for those with very little or no control of their hands. Technologies such as eye gaze detectors, head movement detectors, and voice-recognition software can be used to control computers hands-free. The QUHA ZONO Gyroscopic Mouse is one example of this. It is a device

that can be worn on the head that allows mouse control using head movements. Furthermore, it is lightweight and wireless, so it can be worn in the most comfortable way for the individual and is non-restrictive to their movements. However, it costs AU$1,165.

Touch Screens

Even though they are not designed specifically for people with disabilities, touch screens can also be a great tool for increasing computer access, specifically for people with cognitive disabilities. People with intellectual disabilities and autism, and young children, can often use touch screens to navigate the computer with little or no instruction. This is because pointing at something you want is a very natural way to communicate (Spectronics, 2015). Touch screen monitors can be bought separately from the computer, and range in price, starting at around AU$300.

Using a Keyboard

HelpiMini

Table 13: HelpiMini Parameters

Name: HelpiMini	**Information**
Cost	AU$490
Durability	Not specified
Safety	Not specified
Ease of Use	Works as a normal keyboard with USB connection
Personalisation	N/A

For those with physical impairments, standard keyboards may be difficult or impossible to use. Fortunately, alternative keyboards exist so that people with some control of hand movement can type. Small, one-handed keyboards, such as the HelpiMini, can be used by people with control of only one hand. This keyboard is AU$490, and works with a USB connection to any Windows computer. It is small enough to type with one hand, and the keys are extra sensitive to allow typing without applying much pressure. Overall, it is a compact, portable, and easy to use keyboard alternative for those who need to type with one hand.

Figure 15: HelpiMini

Dragon NaturallySpeaking

Table 14: Dragon NaturallySpeaking Parameters

Name: Dragon NaturallySpeaking	Information
Cost	AU$200
Durability	N/A
Safety	N/A
Ease of Use	Interactive tutorial, smart formatting, word and phrase corrections,
Personalisation	Adapts to user's voice, adapts to formatting preferences

Figure 16: Dragon NaturallySpeaking

There are also technologies for those with very little or no control of their hands. The Dragon NaturallySpeaking screen reader is one of these technologies. It costs AU$200, and allows for computer use through voice recognition. After the initial setup, it should be straight-forward and easy to use. Mainly, this is because the user only needs to speak into a connected microphone, and the program will convert their words into text and input them into the computer as if they were typed on a keyboard. The program also adapts to the user's individual voice, making it more accurate if used over time.

Reading the Computer Screen

Focus 14 Blue

Table 15: Focus 14 Blue Parameters

Name: Focus 14 Blue	Information
Cost	AU$1,570
Durability	20 hour battery life, rechargeable
Safety	Not specified
Ease of Use	Highly responsive keyboard, compact design, Braille Study Mode to teach Braille
Personalisation	Both USB and Bluetooth connectivity, selectable firmness of the moving pins, works with Windows, Mac, and smartphones

Figure 17: Focus 14 Blue Braille Display

Additionally, Braille displays, such as the Focus 14 Blue, can translate the text on the screen into Braille with a series of mechanical, moving pins. Although this product is expensive at AU$1,570, it has quite a few important features. It has 14 mechanical Braille characters with moving pins for

Braille output, as well as keys that allow for Braille typing. Additionally, it is very versatile, and can be used on Windows, Mac, and iOS devices through either USB or Bluetooth connections.

NonVisual Desktop Access

Table 16: NonVisual Desktop Access

Name: NonVisual Desktop Access	Information
Cost	Free
Durability	N/A
Safety	N/A
Ease of Use	Reports textual formatting, automatically announces text under mouse, easy to use talking installer
Personalisation	44 languages, supports Braille displays, support for common interfaces and programs

Another useful tool for computer use by those with visual impairments are screen reader programs, which reads the text on screen in a synthesised voice. In particular, there is a program called NonVisual Desktop Access (NVDA) that is a free open source screen reader. This can be an incredibly useful tool for blind or low vision people using computers, as it converts visual text into audio output for many popular computer applications (NV Access, 2015).

Security Technology

An important aspect of living independently is ensuring that the individual feels safe and secure. Having the ability to lock and unlock their front door can be a key component for living alone. This gives the client the power to control who does and who does not enter their home. Installing outdoor cameras can assist the client in identifying who is at their front door. Global Positioning System (GPS) locators can also give carers or family members a peace of mind that their client or loved one is safe.

Locking and Unlocking Doors

Giving a client the power to lock and unlock their doors at the touch of a button is something the clients want**.** They want to feel empowered by granting access to people at their door. Some clients even keep their doors unlocked in case of an emergency. A couple examples of technology that exists for unlocking and locking doors are the August Smart Lock and Sesame.

August Smart Lock

Table 17: August Smart Lock Parameters

Name: August Smart Lock	Information
Cost	AU$400
Durability	One year warranty
Safety	Secure communication technology, similar to that used by banks for online banking
Ease of Use	App on a smartphone or tablet
Personalisation	Can grant access to certain people for specific times of the day

Figure 18: August Smart Lock

The August Smart Lock is a lock system that allows individuals to remotely control the deadbolt on their door. It can replace the already existing deadbolt on the door, making it easy to install and retrofittable into any home. The lock is constantly connected to the user's smartphone or tablet via Wi-Fi. However, in a scenario where the Wi-Fi no longer works, the August Smart Lock will connect to the device via Bluetooth, ensuring that the user's phone or tablet will always be connected to the lock. It is secured with the same communication technology that is used for online banking. One of the features of the lock is being able to grant access to certain people for specific times and days. For example, if a client has the August Smart Lock, they can allow their carer to enter their home at a certain time or on specific days. Just by using an app on a smartphone or tablet, the client immediately has access to who can and cannot enter their home. This product is currently available for approximately AU$400. This includes the lock and a onetime AU$65 fee for the August Connect, which connects the lock to the current Wi-Fi that is established in the home (August, 2015).

Sesame Smart Lock

Table 18: Sesame Smart Lock Parameters

Name: Sesame Smart Lock	Information
Cost	AU$115 just lock, AU$190 lock with Wi-Fi Access Point
Durability	Lithium batteries last about 500 days
Safety	Military grade encryption (AED 256-bit)
Ease of Use	App on smartphone or tablet.
Personalisation	Create a special knock to unlock door. Share access to certain people for specific times of the day

Figure 19: Sesame Smart Lock

The Sesame Smart Lock, produced by the Candy House Company, is a new smart lock available that allows a phone or tablet to be a key. It uses lithium batteries that last around 500 days. For safety, the Sesame Smart Lock uses military grade encryption to ensure that the lock cannot be opened by unauthorised users. The design of the lock is unique because it fits over any deadbolt lock. This lock also allows for remote access through an app or even a special knock on the door that is recognised by the lock. Much like the August Smart Lock, the Sesame Smart Lock allows the user to share access to the lock to guests for specific times and days. It utilises Wi-Fi and Bluetooth to constantly be connected to the user's phone or tablet. This product can be pre-ordered for AU$115. A Wi-Fi Access Point can also be purchased to ensure that the device is constantly connected to the established Wi-Fi network within the home (CANDY HOUSE, 2015). At this time, the Wi-Fi Access Point cannot be purchased separately, but it can be bought with the Sesame Smart Lock for around AU$190.

Home Security

In order to assist with locking and unlocking the front door, outdoor cameras can be installed to view the front door. The client can have the ability to see who is at their door before deciding whether or not to let them enter. It also ensures that the client's home is constantly being monitored, even when the client is not home.

FOSCAM Outdoor IP Camera

Table 19: FOSCAM Outdoor IP Camera Parameters

Name: FOSCAM Outdoor IP Camera	Information
Cost	AU$119
Durability	Hardened weatherproof outdoor case
Safety	WEP and WPA encryption
Ease of Use	View from internet browser
Personalisation	Able to place anywhere

Figure 20: FOSCAM Outdoor IP Camera

The FOSCAM Outdoor IP Camera can be used to remotely view who is in the range of the camera as well as show recordings through computers and mobile devices in current time (Z-Wave Home Automation Australia, 2015). This feature can be done on a web browser via Wi-Fi which shows the client who is at their

front door. The camera has high quality video and enclosed in a hardened weatherproof outdoor enclosure (Z-Wave Home Automation Australia, 2015). It supports Wired Equivalent Privacy (WEP) and Wireless Protected Access (WPA) encryption to prevent unauthorised access (Red Hat, 2014). The camera features night vision for up to 30 meters and includes a motion detector that can send alerts and video to the user and can be purchased for AU$119 (Z-Wave Home Automation Australia, 2015).

GPS Location

GPS technology is primarily used today to provide turn-by-turn directions while driving. Additionally, GPS can also be utilised to find individuals who have gone missing. This kind of technology can be extremely beneficial for clients who wander away from their homes and do not have a smartphone that can be located. They can quickly be found and brought back to their home. Some examples of GPS locating technology are PocketFinder and Trax.

PocketFinder

Table 20: PocketFinder Parameters

Name: PocketFinder	**Information**
Cost	AU$170 with monthly fee of AU$17
Durability	Up to five days of battery life before recharging. Tag is waterproof.
Safety	Not specified
Ease of Use	App on smartphone or tablet
Personalisation	Geo-Fence Zones, track multiple devices

PocketFinder is an easy to use GPS locator tag that can be used for children, adults, pets, and vehicles (PocketFinder, 2015). Through the PocketFinder app, a user can identify exactly where their children or loved ones are. This app has a feature called Geo-Fence Zones, which allows the user to set zones and receive alerts when a device enters or exits that zone (PocketFinder, 2015). This feature can be used to monitor whether a person with a disability is leaving their home. If they are, the GPS locator can assist in finding them if they have wandered. PocketFinder has a rechargeable battery, with a single charge lasting up to five days (PocketFinder, 2015). It is sold for around AU$170 in addition to a monthly fee of around AU$17.

Figure 21: PocketFinder

Trax

Table 21: Trax Parameters

Name: Trax	Information
Cost	AU$289
Durability	Made from PMMA & Polycarbonate plastic. Water resistant and can be used in a range of temperature from -10°C to 40°C. One year limited warranty
Safety	Not specified
Ease of Use	App on smartphone or tablet
Personalisation	Geo-Fence Zones, track multiple devices

Trax is a GPS locator tag that lets people locate individuals through a mobile app or a computer (Trax, 2015). An individual who wanders can be located if they are carrying the Trax tag. The tag can be placed on a keychain, in a backpack or purse, or simply in the individuals' pocket. The tag is made from PMMA (polymethylmethacrylate) and Polycarbonate plastic, which are the same plastics used in shatterproof windows. A feature is being developed so that the GPS locator can work by tracking a smartphone or tablet rather than the tag. The tag is water resistant and can withstand a wide range of temperatures, making it useful for any environment. Similar to the PocketFinder, this device supports Geo-Fencing Zones where user can receive alerts when a person leaves or enters a specified zone. Another feature that the Trax app supports is Augmented Reality where you can use the camera on a mobile device to locate and show the distance from the people who you are connected to (Trax, 2015). The device can be purchased online for AU$289, which includes a Trax GPS Tracker and a prepaid data plan. After two years of service, Trax comes with a monthly fee of AU$5 for a continued data subscription. However, there is no service commitment and the data subscription can be cancelled at any time (Trax, 2015).

Figure 22: Trax

List of Technology Suppliers

To make future research on assistive technologies easier, we have developed a list of technology suppliers for the use of the EWTF. This way, the user can start by going directly to the websites of these suppliers. We provided information on each supplier in the list, including a link to the website, the specialties that the supplier focuses on, available products, and location. We included the specialties of the supplier in order to give an idea of what kinds of solutions their product can provide. Similarly, a column of some available products is included in order to help the user find a specific product they are

looking for. Finally, including the location of the supplier can help decide how easy it is to purchase from that supplier. A small section of the list of suppliers can be seen in Table 22.

Table 22: Generated List of Technology Suppliers

Supplier	Link	Specialties	Products include	Locations
Spectronics	http://www.spectronics.com.au/	communication	communication tools	Underwood, Queensland
			keyboard/mouse alternatives	
		computer access	portable notetakers	
			writing/drawing tablets	
		switches	ipad accesseries	
			switches	
		mounting devices	switch adapters/interfaces	
			environmental controls	
		music	mounting devices	
			music	
Quantum Technology	http://www.quantech.com.au/	low vision	cognitive/learning disability software	Rydalmere, NSW
			Alternative format production software	
		blindness	magnification units	Cheltenham, Victoria
			scanning and reading devices	
			computer talking software	
		learning disabilities	braille writers/emossers	
			brailler notetakers/displays	

In order to have the largest selection of technologies available, we researched 14 technology suppliers. The list includes all suppliers that we believe can be of use to the EWTF, based on their prices, specialties, location, and available products. Both generic suppliers and those focusing on products for specific disabilities were included, as they serve different purposes. Suppliers that focus on blindness, for example, will have products that fit the more specific needs of a blind individual. On the other hand, generic assistive technology suppliers, such as Spectronics, tend to have basic, off-the-shelf products that can be used by people with varying disabilities. Therefore, we have found that it is best to look at both

suppliers with a specific focus and suppliers with a general focus to identify a larger range of assistive technologies.

Updating the List of Technologies

The assistive technologies market is continuously growing and changing because of the rapid advancement of technologies. Due to this, the list of technologies that we provided the EWTF will eventually become out of date. Additionally, the current list, while extensive, may not include a specific technology that a client of the EWTF wants or needs. Therefore, it is important that the list is continuously appended to keep it comprehensive and up to date. In order to assist in this, we have developed a questionnaire that could be sent to suppliers every six months. The systematic research process previously mentioned can also be a useful updating tool.

Technology Supplier Questionnaire

The relationship between the EWTF and technology suppliers plays a key role in updating the list. By having a long term, two-way relationship with these technology suppliers, the EWTF is able to keep the list as up to date as possible. In this case, an effective two-way relationship would be one where both businesses benefit by keeping open communication.

The EWTF may consider sending a questionnaire to selected technology suppliers every six months to learn about new and updated technologies. It can also inquire about any price changes within the past six months. The questionnaire serves several purposes. First, it shows that the EWTF is proactive in providing their clients with the most up-to-date technology. It also helps the EWTF keep in contact with the technology suppliers. Sending out the questionnaire can also aid the clients of the EWTF because they can receive updates on existing technologies as well as learn about new technologies. After receiving the questionnaires, the team in charge of updating the list can include any new technologies to the list and even modify technologies that have been updated. A sample questionnaire that may be used by the EWTF can be found in Appendix D.

In addition, the technology suppliers can also send newsletters to the EWTF. These newsletters can highlight any major updates in technology or new technology that the supplier has in stock. After receiving the newsletters, the team in charge of keeping the list updated can append new technologies to

the list or modify existing technologies. However, since not all suppliers have newsletters the questionnaire mentioned above is an important step in the process of updating the list.

Discussion

The goal of this project was to identify a range of assistive technologies that can be used by the EWTF to improve the independence and quality of life of its clients. Based on the interviews conducted with EWTF staff, carers, clients, as well as an occupational therapist we were able to identify more specific needs that clients had. In particular we identified five main categories of need – home automation, information and communication, health, computer access, and security. We then researched and identified 86 technologies that can help clients. Moreover, our research allowed us to discover a few more major themes regarding assistive technologies. These themes helped us develop some recommendations and future projects that may be able to enhance the effectiveness of our work.

Finding #1: Assistive Technologies Were Not Always Specifically Designed for Individuals with Disabilities

Our research has been directed towards technologies that will help an individual live independently. Through this research, **we found that assistive technologies were not always specifically designed for people with disabilities.** Technology can be a product that specifically assists individuals with disabilities, such as an electric wheelchair, or a product that can help anyone, such as home automation technology. Home automation technology was created so that individuals can feel more comfortable within their own homes. Both specialised and non-specialised technologies can assist a person with a disability because it can empower them to control the environment around them.

Finding #2: There is No "One Size Fits All" Technology

Due to the fact that the EWTF focuses on the goals and needs of each individual client, we included a wide variety of technologies that can assist with common client needs. However, through our research, **we found that there is no "one size fits all" technology.** There is no technology that can be used by every single client within the EWTF. This is because the EWTF serves a wide range of individuals with many different disabilities. Clients that have similar disabilities, such as autism, can have very different needs and goals. These needs and goals are based on what the client wants and how their disability affects them. Due to this, each client may need a different type of technology that covers different uses. A technology that applies to all clients is also difficult to find due to the different needs of each of the four disabilities we researched – physical, intellectual, ABI, and autism. However, all of the

technologies that we have found can touch upon at least one of the disabilities that we researched, such as one-handed keyboards for people with physical disabilities. Furthermore, some technologies are capable of meeting the needs of many individuals with different disabilities.

Finding #3: Lack of Consistency When Researching Parameters

Throughout our research, **we found that there was a lack of consistency when researching the parameters – cost, durability, safety, ease of use, and personalisation.** This could be because of the difference in the functionalities of the technologies that we researched. For some technologies, such as automated lighting, the parameters were easy to identify. However, parameters of other technologies, such as information and communication technologies, were much harder to quantify. This made comparing technologies difficult. Table 23 shows the distribution of the parameters that were specified, not specified, or not applicable (N/A) for each category.

Table 23: Parameter Distribution

		Cost	Durability	Safety	Ease of Use	Personalisation
Home Automation (25)	Specified	25	10	2	8	14
	Not Specified	0	15	23	17	11
	N/A	0	0	0	0	0
Information and Communication (13)	Specified	3	0	0	0	13
	Not Specified	10	0	0	13	0
	N/A	0	13	13	0	0
Health (9)	Specified	8	3	4	9	9
	Not Specified	1	1	1	0	0
	N/A	0	5	4	0	0
Computer Access (20)	Specified	20	7	1	20	19
	Not Specified	0	7	13	0	0
	N/A	0	6	6	0	1
Security (19)	Specified	18	14	15	18	19
	Not Specified	1	5	4	1	0
	N/A	0	0	0	0	0
TOTAL (86)	Specified	74 (86%)	34 (40%)	22 (26%)	55 (64%)	74 (86%)
	Not Specified	12 (14%)	28 (32%)	41 (48%)	31 (36%)	11 (13%)
	N/A	0 (0%)	24 (28%)	23 (26%)	0 (0%)	1 (1%)

Cost was a consistently found parameter throughout our research. The cost of a product was specified for 74 out of 86, or 86%, of technologies on the list. This is because cost is easily quantifiable and measurable as a definite number. The remaining 12, or 14%, of the technologies that did not specify cost were products that were priced for an organisation or individual. We were able to compare technologies with similar functionality based on their cost.

The personalisation of technology was specified for 74 out of 86, or 86%, of the technologies we researched. This usually included different settings that were available or the ability to fine tune how a technology works. For example, a client with a smart lock would have the ability to give access to certain people only at specific times, with a unique code that they can choose. Of the 12 that were not specified, 11 were from the home automation category. This is because these devices were either controllers or light switches that did not provide different settings for the user to program.

The ease of use parameter was specified for 55 out of 86, or 64%, of the technologies we researched. This number is lower than personalisation and cost because the ease of use parameter is subjective to the individual that is using it. For individuals who are technologically savvy, a device may be easier to use than for someone who may not understand technology. Certain products may have been designed to be easy to use. For products that were not specifically designed to be easy to use, it would not be practical for a technology supplier to specify that information. Nonetheless, in such cases, technology suppliers may have included training or online tutorials on how to use the technology.

The durability of assistive technologies was provided for 34 of the 86, or 40% of the technologies on the list. Durability referred to the lifespan of the product. When a technology's battery life or waterproofness (waterproof up to 30m) was of concern, the information was provided. For instance, we were able to find that Philips Hue Light Bulbs had an expected lifespan of 15,000 hours. For 24 of the 86 technologies we researched, or 28%, durability was considered N/A. This is because most of those technologies were software and durability was not taken into consideration.

Information regarding the safety of a technology was irrelevant for many technologies. For 22 out of 86 technologies, or 26%, information on the safety of the technology was specified by the manufacturer. This was related to technologies where privacy or physical harm was relevant. However, for technologies without such concerns, 23 out of 86 technologies, or 27%, it would be impractical to provide safety information. Therefore, these devices were recorded as N/A. For example, it would not be necessary to provide safety information for software such as a voice recognition program since there are no prevalent safety concerns dealing directly with the software itself. Yet, safety information, e.g.,

encryption or firewalls to safeguard the information, would be provided for software that stores and shares medical records with care providers.

Recommendation #1: Make the List Easily Accessible and User Friendly for the Clients

In order for the clients of the EWTF to benefit from the list of technologies, they should have a way to access it. Therefore, **we recommend that the EWTF makes the list easily accessible and user-friendly for clients.** There are several different ways this can be achieved.

Some of the clients we talked to use a computer or a tablet on a regular basis to access the internet. For these clients, an online database or electronic newsletter would be the best way for them to gain information on available technologies. The EWTF may choose to create an online database that is available for all clients, include a technology page on their website, design an app for a smartphone or tablet, or implement it into their already existing Carelink+ system.

These options would be better than the list on an Excel spreadsheet for a number of reasons. First, the list could be easier to navigate on a website or through an app as opposed to the Excel spreadsheet. The current spreadsheet has one search tab which can filter the list, but then needs to be filtered based on the headings of the columns. An online database will also be easier for updating the list of technologies. Instead of updating the technologies on an Excel spreadsheet and then resending it out to clients, updates to the list can be made on the database. The database will then update the list and anyone who accesses it knows it will include the latest appendages.

However, not all clients are able to access computers, tablets, or even the internet regularly. In addition, some clients reported that they did not read their email regularly and infrequently visited the EWTF website. Therefore, an online database may not best serve all EWTF clients. Based on this, we recommend that the EWTF include a section on available assistive technologies in the already existing EWTF newsletter, “Tipping Talk”. This ensures that all clients will receive a copy of the technology options that are available to them.

Recommendation #2: Assign Two to Three Staff Members the Task of Updating the List

The swift advancement of technologies means the list will need to be continuously updated. This can ensure that the clients are receiving the most up to date technology. After discussing

this recommendation with EWTF staff, we suggest that two or three staff members be in charge of keeping the list up to date. Some executive staff members believe that it will take more than one person to keep the list updated, but no more than three. Therefore, **we recommend that the EWTF assign a team of two or three staff members to the task of continuously updating the list.** These staff members can be from the Client Outcomes and Services Improvement department, the Operations department, or the Carelink+ department. The two ways to continuously update the list, the technology supplier questionnaire and the systematic research process, are explained in detail in the Results section.

Future Work #1: Assessment of the Parameters of Assistive Technology

A future project could involve the assessment of the five parameters we have identified, which we believe should be taken into consideration when researching technologies – cost, ease of use, safety, durability, and personalisation (Gitlin, 1995). **The goal of this project would be to assess these parameters of assistive technology.** This project is important because it can further define the parameters, explain how they can be measured, and identify any other parameters that should be considered when researching assistive technology. This project may also identify the different parameters that are important when looking at the functionalities of each technology.

Future Work #2: Designing a Rating System Based on Client Feedback

Another future project that can assist with finding parameters is developing a rating system for the parameters. **The goal of this project would be to receive feedback from clients that are using technology and design a rating system based on this feedback.** Customer reviews on technology supplier websites can also be useful in creating a rating system. More research on any agencies in Australia that test products and rate them may also be useful. After conducting research and receiving feedback from clients, the project can then rate the parameters of technologies, as well as rate the technologies as a whole. If a technology receives a rating below a certain threshold, it could undergo a review process and possibly be taken off the list. The rating system can then be viewed by all clients when researching technology for a specific need. This may help the EWTF find the best technology options that are available to their clients.

Future Work #3: Develop a User-Friendly App to Improve Client Accessibility

Many recently developed technologies take advantage of the wide usage of mobile devices. They are versatile and modifiable, which makes them work well for a variety of specific needs. Apps can be created for a relatively low cost, and can be personalised to suit the needs of an individual. Additionally, many people with disabilities use smartphones or tablets for a variety of the useful features they have. Every client that we spoke with took advantage of either a smartphone or tablet, and most wanted to expand on their use by discovering useful new apps. **The goal of this project would be to create an easy to use and organised app of the list of technologies to improve its accessibility.** This project is directly related to Recommendation #1. An example of what the app might look like is provided in Figure 23.

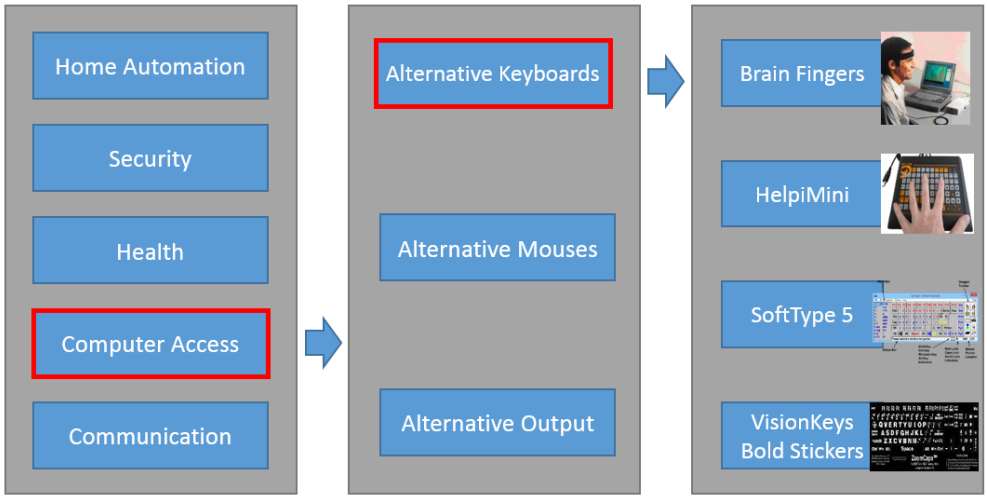


Figure 23: Example of an App

Future Work #4: Assessment of the Updating Process the List of Technologies

The goal of this project would be to assess the process for updating the list. This would include an assessment of how often and efficiently the list is being updated. Additionally, the project could also aim to find new ways of updating the list that could be more efficient. Considering how often technologies are updated and further developed, the process by which the list is updated could also be improved upon. A more efficient process could save the EWTF time and resources.

Conclusion

We researched assistive technologies that could help individuals live independently based on certain parameters that we believe are important. With this updatable list of assistive technologies, the clients of the EWTF can view assistive technology options that they can purchase to improve their independence and quality of life. Thus, these technologies have the opportunity to be very empowering for an individual with a disability. The list also assists the EWTF as a disability service provider. Providing the clients with a range of options for assistive technologies can not only help current clients, but may also help recruit new clients. With this list, if a client needs to turn on their lights when the sun goes down, or write an email to a family member or a friend, they have the opportunity to obtain the technology that can enable them to achieve these goals and assist with their needs. We expect that, with the help of list we developed, the clients of the EWTF will be able to fully take advantage of the assistive technology options available in today's market, allowing them to live full and independent lives.

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Appendix A:

Interview Questions for E.W. Tipping Staff Members

1. What is your role at E.W. Tipping and how is it related to clients if at all?

2. Are you aware of any technologies that currently assist clients?

3. What are some specifications, such as ease of use, durability, etc., that you feel are important when selecting technologies?

4. What is the current process for finding and implementing technologies that will assist the clients?

5. Are there other organisations that the E.W. Tipping Foundation is working with to benefit their clients?

Appendix B:

Motivational Interview Questions for Clients

1. What daily tasks are you confident accomplishing independently? What daily tasks do you need support to accomplish?

2. What would a technology that helps look like to you?

3. Have you used anything to help you with these tasks? If so, are you still using it? Why or why not?

4. If you knew what kinds of technologies were available and in your price range, would you be more likely to use technology?

5. Would you like to learn how to use a new technology? Why or why not?

Appendix C:

Interview Questions for Carers

1. What is the nature of the client's disability? How does it affect them in general?

2. In what ways do you assist the client in their daily lives?

3. What ways can you see technology help the client living independently?

   What ways can you see technology help the client live more comfortably?

   What ways can you see technology being useful to enhance the services your client receives?

4. What is most important when considering technologies for the client? (e.g. price, durability, ease of use)

5. Has the client used assistive technology in the past? Did they continue to use it or abandon it? Why?

Appendix D:

Sample Technology Supplier Questionnaire

Company:_____ Date:___/___/_____

Name:_____

Here is a list of products that we are currently offering to our clients

_____
_____
_____
_____
_____
_____
_____

Are there any products new to your company as of 6 months ago? Yes_____ No _____

If yes, please list the name of the technology, price, function, and other important specifications

_____
_____
_____
_____
_____
_____
_____
_____

Are there newer versions of any of your technologies as of 6 months ago? Yes_____ No _____

If yes, please list the technology, any changes and improvements, and the old and new price

_____
_____
_____
_____
_____
_____
_____
_____
_____

Has the price of any technologies you supply changed? Yes_____ No _____

If yes, please list the technology, old price, and new price

_____
_____
_____
_____
_____
_____
_____
_____
_____