SPEECH-LANGUAGE PATHOLOGISTS' PRACTICES AND ATTITUDES TOWARD APP USE IN THERAPY

by

Tessa A. Benedon

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ABSTRACT

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Tessa A. Benedon

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Under the Supervision of Professor Shelley Lund, Ph.D., CCC-SLP

Numerous national surveys have established that Americans of all ages are using mobile technologies (e.g. cell phones, smartphones, and tablets) more than ever before (Pew Research Center, 2018; American Academy of Pediatrics, 2016a; American Academy of Pediatrics, 2016b; Reid-Chassiakos et al., 2016; Tsetsi & Rains, 2016; Kabali et al., 2015). In the same vein, Morris, Jones, and Sweatman (2016) found that Americans with visual, hearing, motor, learning, and speech disabilities area also engaging with apps on smartphone and tablet technologies for vocational, educational, and social purposes. Developers of the iOS and Android operating systems have prioritized user-friendly design and accessibility features to improve access of mobile technologies to the greatest number of users ("Android Accessibility Help," 2017; Apple, 2017).

Rehabilitation professionals are interested in changing or modifying behaviors to help their clients meet therapy goals and access high quality of life outcomes. Multiple resources have supported that people form new behaviors and habits related to use of their smartphones (Peters, 2009; Wood & Neal, 2008; Oulasvirta, Rattenbury, Ma, & Raita, 2012); therefore, smartphone apps could possibly assist rehabilitation professionals when providing treatment to people with disabilities. Other survey-based studies of Occupational Therapists (OTs) (Kyaio, 2015) and

Speech-Language Pathologists (SLPs) (Zajc, Istenic-Starcic, Lebenicnik, & Gacnik, 2018) have confirmed that app-based interventions and therapy tools have already infiltrated the field of rehabilitation (Peters, 2009; Wood & Neal, 2008; Oulasvirta et al., 2012), despite the lack of evidence establishing the efficacy of many app-based interventions (Newmann, 2017; Papadakis, Kalogiannakis, & Zaranis, 2017b; Schoen-Simmons, Paul, & Shic, 2016; Erickson, 2015; Stone-MacDonald, 2014). Collectively, these studies highlight the urgency of integrating evidence-based practice (EBP) into an SLP's service delivery decisions related to app use, especially now that apps and mobile technologies are being developed and available for purchase by the public at unprecedented rates.

The purpose of this study was to survey practicing, certified SLPs in the U.S.A. to examine current attitudes and opinions toward the use of apps for purposes related to speech-language therapy. This survey was conducted utilizing the Qualtrics survey platform to maximize data security, access data, and perform data analysis. The web-based survey consisted of 48 questions which were designed to (1) examine common trends in demographic features of SLPs who use apps in therapy, (2) examine the purposes for which apps were used and which skills SLPs targeted when using apps in therapy, (3) examine the variety of barriers which SLPs may face when using apps or mobile technologies in therapy, and (4) examine the factors which SLPs consider when purchasing apps. There were 228 SLPs who participated in the study. All had their certificate of clinical competence (CCC-SLP) or were currently in their clinical fellowship year (CFY-SLP) and practiced in the United States of America. Results of the study indicate that therapists of varying demographic features who see patients across pediatric and adult settings are using apps to target therapy goals. Clinical implications and directions for future research are discussed.

To

my grandparents Anne and Glenn,

my parents Chuck and Judy,

my family and friends,

and to all of my research mentors and thesis committee,

thank you for your contributions to my successes thus far.

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lessons. To you, I owe the most gratitude; by the grace of God, you inspired me to pursue a career and life dedicated to reaching high quality of life outcomes for individuals with complex communication needs, and all individuals with speech and language disabilities.

At the end of the tunnel, there will always be light.

SPEECH-LANGUAGE PATHOLOGISTS' PRACTICES AND ATTITUDES TOWARD APP USE IN THERAPY

INTRODUCTION

Mobile technologies (e.g. cell phones, smartphones, and tablets) have become the omnipresent, pocket-sized vehicles to the wealth of knowledge existing within the confines of the world-wide-web. The ubiquitous influence of mobile technologies has allowed for the transmission of ideas and beliefs in real-time in virtually any setting. The continual rebirth of new mobile devices, websites, and applications have provided mobile technology users of all ages a new forum to participate with the world and its people. Although the development of smartphones, tablets, and apps are within their primal stages, they are considered the most recent evolutionary step toward access and storage of portable information and communication technology (Oulasvirta et al., 2012).

Patterns and Trends of Ownership, Use, and Dependence on Mobile Technologies

Adults, teens, and children from diverse sociodemographic backgrounds in the United States of America (USA) have integrated apps into their daily lives (Tsetsi & Rains, 2017; Harper & Milman, 2016; Zhitomirsky-Geffet & Blau, 2016; Glackin, Rodenhiser, & Herzog 2014). For example, adult smartphone and tablet users have reaped the benefits of apps and mobile devices to be used for work purposes (Fenwick & Edwards, 2016). Mobile technologies have been found to increase autonomy, improve productivity, enhance interprofessional communication, and permit efficient access to occupation-relevant data in the workplace (Fenwick & Edwards, 2016; Braun, Catalani, Wimbush, & Irsaelski, 2013). Other research articles have confirmed the presence or use of mobile technologies in vocational settings such as

healthcare facilities and education venues (Fenwick & Edwards, 2016; Glackin, Rodenhiser, & Herzog, 2014). Harper and Milman (2016) reported use of iPad and tablet technologies within K-12 programs across the USA for educational purposes. Cha and Seo (2018) reported various uses of smartphones by middle school students in South Korea, which included interaction on messenger apps, internet surfing, gaming, and social networking.

The Pew Research Center has conducted mixed-mode surveys (i.e. by internet, phone, and paper) of smartphone ownership of American adults dating back to 2011. As of January 10, 2018, 95% percent of American adults across varying demographic groups reported owning a cell phone, and 77% of American adults owned a smartphone (Pew Research Center, 2018). However, rates of smartphone ownership varied when age, household income, and educational attainment were stratified separately. Table 1 presents rates of smartphone ownership in the USA from 2018.

The reported rates of smartphone ownership by the Pew Research Center (2018) directly increased with advanced education. Approximately 57% of individuals with less than a high school diplomas or GED (General Equivalency Diploma) reported smartphone ownership, whereas 69% of high school graduates and 91% of college graduates reported owning smartphones (Pew Research Center, 2018).

In addition to smartphone technology, ownership of other mobile technologies by American adults has increased in the past nine years. According to the Pew Research Center (2018), ownership of desktop and laptop computers by adults in the United States has remained near a steady 78%, whereas access to tablet computers has grown from 3% of American adults in 2010 to 53% of adults in 2018. Consumption of news articles and information is shifting, from

traditional computers and laptops to smartphone and tablet devices, as well (Dunaway et al., 2018).

Table 1.

Rates of Smartphone Ownership in the USA Organized by Demographic Feature

Demographic Feature	Demographic Trait	Portion of Americans that Own a Cell Phone	Portion of Americans that Own a Smartphone
Age (years)	18-29	100%	94%
	30-49	98%	89%
	50-64	94%	73%
	65+	85%	46%
Educational Attainment	Less Than High School Graduate	90%	57%
	High School Graduate	92%	69%
	Some College	96%	80%
	College Graduate	97%	91%
Community Type	Urban	96%	83%
	Suburban	94%	78%
	Rural	91%	65%

Tsetsi and Rains (2017) analyzed data from an earlier Pew Research Center study in 2012 and identified significant relationships between sociodemographic characteristics and trends in smartphone dependency and use. Participants who self-identified as belonging to a minority group, participants under the age of 41 years old, were from low income backgrounds, or reported low levels of educational attainment were more likely to be identified as "smartphone dependent," in which one's only means of internet access was through a smartphone (Tsetsi & Rains, 2016). Types of smartphone use were also associated with age, income, and education (Tsetsi & Rains, 2016). Higher income individuals and white participants reported that they use smartphones to engage in reading news and informational activities, such as reading news articles, finding health information, or visiting government websites, at a higher frequency than lower-income individuals and minority participants. Tsetsi and Rains (2017) also found that

minorities and smartphone users younger than 41 years of age engaged in social activities on smartphone devices more frequently than whites and individuals between the ages of 52 to 72 years old.

The Pew Research Center (2018) projected that the reported rates of adult ownership of mobile devices is expected to rise over the next ten years. Existing literature has established patterns related to increased rates of ownership and use of smartphone and tablet technology in adult populations in the USA, such as higher frequency of consumption of digital news and media online from tablet and smartphones than traditional computers and laptops for personal use, (Dunaway, Searles, Sui, & Paul, 2018) and increased rates of use of mobile tools to support administration of care and patient education in healthcare settings (Braun et al., 2013).

The data above do not account for the number of minors who have been granted access to devices, thanks to household sharing and ownership of the devices (Pew Research Center, 2018). Existing literature has documented smartphone use in infants as young as 18 months through 18 years old (Cha & Seo, 2018). Kabali, Irigoyen, Nunez-Davis, and Budacki et al., (2015) examined children's exposure and use of mobile media devices through use of anonymous, survey-based measures. The children of the parent respondents were six months old to 4 years old. Three-hundred-and-fifty responses were collected, and 96.6% of children had used a mobile device. According to Kabali et al. (2015), 43.5% of children less than one-year-old, and 76.6% of children who were two years old played games, watched videos, or used other apps on a daily basis.

School-age children and adolescents have also been exposed to use of smartphone, tablet, and iPad devices. Such avenues of access include personal smartphone ownership, used for internet access, watching videos, and app use (American Academy of Pediatrics, 2016b; Reid-

Chassiakos et al., 2016), and the deployment of 1:1 computing initiatives in elementary, middle, and high schools in the USA (Harper & Milman, 2016) and globally (Richardson, McLeod, Flora, & Sauers et al., 2013).

Studies designed to establish app use and ownership across sociodemographic groups in the USA (Pew Research Center, 2018; Tsetsi & Rains, 2016) have not explicitly documented the numbers of individuals with physical, intellectual, or developmental disabilities within their samples. In 2016, Morris, Jones, and Sweatman conducted a national survey investigating mobile technology use by people with disabilities. They found that the use of mobile technologies had become a critical component in the lives of American adults with disabilities, including those with speech, motor, auditory, visual, or mental impairments (Morris, Jones, & Sweatman, 2016). This investigation supported the notion that mobile technologies commonly serve as an avenue for social and economic participation for persons with disabilities in the USA. Of 1,008 people who responded to the survey, 845 people reported having one or more of the following disabilities: a motor disability, including difficulty walking, climbing stairs, or difficulty using their hands, fingers, or arms; an auditory impairment; a visual impairment, a speech impairment, an impairment in the area of cognition, including experiencing difficulty concentrating, remembering, or deciding, and/or an impairment in the area of psychological issues, including individuals who frequently worry, are nervous, or have anxiety (Morris, Jones, & Sweatman, 2016). In general, people with all types of disabilities reported that they owned mobile technologies; furthermore, smartphone rates of use were comparable, if not higher, than the general population (Morris, Jones, & Sweatman, 2016).

User-Friendly Operating Systems

A variety of studies provide evidence that mobile technologies and apps are used by people of all ages (Pew Research Center, 2018; American Academy of Pediatrics, 2016a; American Academy of Pediatrics, 2016b; Reid-Chassiakos et al., 2016; Tsetsi & Rains, 2016; Kabali et al., 2015), and in a variety of institutional environments (Glackin, Rodenhiser, & Herzog, 2014), including K-12 education (Harper & Milman, 2016), universities (Fenwick & Edwards, 2016; Kane, Jayant, Wobbrock, & Ladner, 2009), and healthcare settings (Hardyman, Bullock, Brown, & Carter-Ingram et al., 2013). Mobile technologies have been designed with user-friendly initiatives integrated into their operating systems, in order to attract the greatest number of consumers ("Android Accessibility Help," 2017; Apple, 2017). An operating system within a mobile device supports the execution of apps, which are mini-software programs designed for download, practical use, and personalization of one's mobile device (Nahi & Wright, 2000). Users have found apps to be engaging for a variety of reasons; for example, Tian, Nagappan, Lo, and Hassan (2015) analyzed the characteristics of high-rated apps and found that multifunctional apps and apps which promote interaction were more likely to have higher ratings by users.

The two operating systems which have dominated mobile technology markets in the USA include iOS for Apple brand devices, and Android, which runs on Samsung, LG, HTC, Sony, Google, and Motorola devices (Morris & Mueller, 2014). On devices that run iOS, an Apple device user purchases apps from the Apple App Store (Apple, 2017). The number of apps available within the Apple App Store grew from 350,000 in 2011 (Morris & Mueller, 2014) to 2.2 million mobile apps in 2017 (Apple, 2017). On a device that runs the Android operating system, the smartphone user purchases apps from the Google Play Store; there were 3.3 million

apps available at the Google Play app marketplace for purchase in 2018 (Statista, 2018). The authors of the *2017 U.S. Mobile App Report* collected self-reported responses from smartphone users in the USA and concluded that 49% of American smartphone users download apps monthly (comScore, 2017).

Overview of Universal Design and Accessibility Features

Since the introduction of the Twenty-First Century Communications and Video Accessibility Act (CVAA) in 2013, people with disabilities have become an appealing consumer base to mobile technology manufacturers and app developers (Morris & Mueller, 2014). Universal Design and accessibility have become market imperatives for both iOS and Android since the CVAA legislative mandate became active (Morris & Mueller, 2014; Naftali & Findlater, 2014).

Universal Design refers to the competent design of products or services so the greatest number of users can purchase, access, and interact with them ("Accessibility," 2011). One way which iOS and Android developers have integrated Universal Design into their operating systems is by offering various accessibility features. Table 2 is a list of comparable accessibility features found within iOS and Android operating systems, categorized by impairment types ("Android Accessibility Help," 2017; Apple, 2017, Morris & Mueller, 2014). The following paragraphs will briefly highlight some of the accessibility features developed for iOS and Android.

Table 2.

Comparable Accessibility Features for iOS and Android Operating Systems

Type of Impairment	iOS	Android
Visual	*VoiceOver* *Enlarged Print & Zoom* *Guided Checklist*	*High Contrast Text & Zoom* *Select-to-Speak/TalkBack* *BrailleBack + Bluetooth*
Hearing	*LED flash alerts* *Custom vibration alerts* *Mono audio output* *Captions*	*LED flash alerts* *Custom vibration alerts* *Mono audio output* *Captions*
Motor	*Dictation* *Prediction* *Assistive Touch* *Switch Control* *Platform Switching*	*Switch Access* *Touch and Hold Delay* *Speak Passwords* *Predictive Text* *Direct Access*
Learning & Literacy	*Speak Screen* *Speak Selection* *Typing Feedback* *Guided Access*	*Select-to-Speak/TalkBack* *Predictive Text* *Touch Protector*

Individuals with visual impairments. According to Morris, Jones, and Sweatman (2016), 73% of American adults with visual impairments owned smartphones, and 45% owned tablets in 2016. When the group of visually impaired participants were split into two groups, including individuals with low vision, and individuals who were blind, blind individuals were more likely to own a smartphone (82%) than low vision participants (68%), yet blind individuals were less likely to own a tablet (39%) than individuals who self-identified as having low vision (47%) (Morris, Jones, & Sweatman, 2016).

There are a range of accessibility features available for individuals who have visual impairments within both iOS and Android operating systems. For individuals with Apple (iOS) devices, *VoiceOver* is a feature that reads text presented on the display screen aloud and provides descriptions of everything on an individual's screen including battery level, texts, who is calling, or the app which a user's finger is on. Speaking and pitch range of the synthesized voice in

VoiceOver can be adjusted. *VoiceOver* also works for built-in Apple apps and many third-party apps are compatible with this technology. *VoiceOver* is also compatible with Bluetooth braille displays. Accessibility features are available to enlarge print, to zoom, to select custom vibration patterns and custom ringtones for specific callers in an individual's list of contacts. *VoiceOver* was found to be useful for making phone calls and sending short text messages for individuals with visual impairments as described by Wong and Tan (2012).

For Android users, *TalkBack* is a screen-reading setting that provides spoken feedback according to the text that the user selects on the screen ("Android Accessibility Help, 2017). *TalkBack* can also be paired with a swiping gesture which activates spoken feedback for the entire screen. *TalkBalk* is designed to read aloud actions, alerts, and notifications ("Android Accessibility Help, 2017). *Select to Speak* is a similar feature to *TalkBack*, but it only performs screen-reading at certain times ("Android Accessibility Help," 2017). *BrailleBack* also may work with *TalkBack* when a user with a visual impairment connects a refreshable braille display to their device via Bluetooth ("Android Accessibility Help," 2017). *Voice Access* allows a user to control the device with voice commands, which allows a user with visual impairments to use their voice to open apps, navigate on their device, and edit text. This feature was only available in English only as of 2017 ("Android Accessibility Help," 2017). In addition, there are other accessibility features are available to adjust display size, font size, to zoom using magnification gestures, and to modify contrast and color options including high-contrast text, color inversion, and color correction (Morris & Mueller, 2014).

Individuals with hearing impairments. According to Morris, Jones, and Sweatman (2016), 74% of American adults with hearing impairments owned smartphones, and 56% owned tablets in 2016. When the group of hearing impaired participants were split into individuals who

were hard of hearing (HOH), versus individuals who were deaf, deaf individuals were more likely to own a smartphone (80%) than HOH participants (71%), and deaf individuals were more likely to own a tablet (63%) than individuals who were HOH (53%) (Morris, Jones, & Sweatman, 2016).

Both iOS and Android offer the same accessibility features for users with hearing impairments which include captioning, LED flash alerts, custom vibration alerts, and mono audio output. For individuals with hearing impairments, captions of varying language, text, and style have been made available to users ("Android Accessibility Help," 2017; Apple, 2017; Morris & Mueller, 2014). Custom vibration ringtone and alert patterns, and mono audio settings are available. Mono audio settings were designed to allow the user to adjust the audio output and sound balance between the left and right channels, which is especially appropriate for (HOH) individuals with different degrees of hearing loss between ears ("Android Accessibility Help," 2017; Apple, 2017; Morris & Mueller, 2014).

Individuals with motor or mobility impairments. In the survey data examined by Morris, Jones, and Sweatman (2016), American adults with motor impairments were split into different categories including individuals who had difficulty using their arms, individuals who had difficulty using their hands or fingers, and individuals who had difficulties walking or climbing stairs. Of individuals who had difficulty using their arms, 17% used basic cell phones, 59% used smartphones and 42% owned tablets. Of individuals who had difficulty using their hands or fingers, 16% used basic cell phones, 59% used smartphones and 45% owned tablets. Of individuals who had difficulties walking or climbing stairs, 16% used basic cell phones, 64% used smartphones and 46% owned tablets. Individuals with motor impairments were more likely to use basic cell phones than individuals with hearing impairments, speech impairments, visual

impairments, cognitive impairments, or anxiety. Morris, Jones, and Sweatman (2016) inferred that this could be due to a few factors, including that basic cell phones provided better tactile feedback using the keypad than the tactile feedback permitted by a touch screen, may decrease slippage, and may be more durable and resistant to damage when dropped than smartphones with touch screens.

Naftali and Findlater (2014) conducted a qualitative investigation to gain quality insights from smartphone users with motor impairments. This research study investigated the ways in which smartphones were being used by individuals with motor impairments. The investigation revealed that individuals with motor impairments found both Android and iOS accessibility features to be helpful. Participants described that smartphones were primarily used for communication, entertainment, web browsing, reading news and articles, weather reports, and scheduling (Naftali & Findlater, 2014).

There are a variety of accessibility features available to Apple (iOS) users with motor impairments. *AssistiveTouch* was developed to create custom gestures to replace touch screen interactions, especially for people who have fine motor limitations. For example, an individual who has difficulty swiping down to scroll may set up a gesture, such as raising a pointing finger or two fingers up, which is picked up by the device's front facing camera (Apple, 2017; Morris & Mueller, 2014). *Predictive Text* is also available on all Apple devices, which was designed to improve transmission speed of written messages across diverse communication contexts (Apple, 2017; Beukelman & Mirenda, 2013).

In addition, *Switch Control* was designed by Apple (2017) for individuals with motor impairments to navigate items on the screen in a sequential fashion. *Switch Control* was also designed to connect with a variety of Bluetooth switch hardware. iOS developers also made the

Switch Control setting compatible with *Platform Switching*, allowing operations and operation settings of mobile technologies to be synced to the user's *iCloud* account (Apple's document sharing system between devices). For example, a user could control an iPad directly from their iPhone or laptop computer (Apple, 2017).

For Android users with motor impairments, *Switch Access* is available if an alternative selection method to using the touch screen is preferred ("Android Accessibility Help," 2017). *Speak Passwords* is able to speak aloud passwords (Morris & Mueller, 2014), and touch and hold delay can be adjusted for individuals with motor impairments (Morris & Mueller, 2014).

Individuals with learning or literacy impairments. In the national survey data presented by Morris, Jones, and Sweatman (2016), individuals with cognitive impairments were identified as individuals with "difficulty concentrating, remembering, [and] deciding" (Morris, Jones, & Sweatman, 2016, pp. 104). Because the described cognitive symptoms are not congruent nor descriptive enough to accurately describe learning and literacy impairments, it is not appropriate to compare all individuals with learning and literacy impairments to individuals with cognitive impairments. Therefore, it would not be appropriate to use the rates of basic cell phone, smartphone, and tablet ownership by individuals with cognitive impairments who responded to the survey data incorporated in the research presented by Morris, Jones, and Sweatman (2016) to individuals with learning and literacy impairments.

There are a variety of accessibility features available within both iOS and Android operating systems. For iOS users identified with literacy or learning impairments, *Speak Screen*, *Speak Selection*, *Typing Feedback*, and *Prediction* are available to assist users who benefit from auditory presentation of written text, or rate enhancement of written output for academic, vocational, or social functions (Apple, 2017). The iOS accessibility features, *Speak Screen* and

Speak Selection, are comparable to the functions of Android's *Select-to-Speak/TalkBack.* iOS *Prediction* and Android *Predictive Text* perform similar functions, as well.

Guided Access for iOS and *Touch Protector* for Android perform similar functions. Another adult, such as an educator, parent, or therapist may limit the iPhone or iPad to stay on one app. *Guided Access* can disable the home button and place limitations on time spent within one app so that more time can be spent learning. Ward, Finley, Keil, and Clay (2013) found that the *Guided Access* feature within iPads increased engagement and concept building in K-12 science, technology, and mathematics curriculums. Frank, Sugarman, Horowitz, and Lewis et al., (2016) used *Guided Access* when utilizing iPads to demonstrate a science lesson with young children between the ages of one to four years aiming to increase attention and engagement, and minimize distractions within the device.

Given the range of accessibility features available within both Android and iOS operating systems ("Android Accessibility Help, 2017; Apple, 2017; Morris & Mueller, 2014), many people with visual, auditory, motor, and literacy impairments have been found to incorporate mobile technologies for a variety of uses into their daily lives (Morris, Jones, & Sweatman, 2016; Naftali & Findlater, 2014).

Promoting Goal-Oriented Behaviors for Rehabilitation

Rehabilitation therapists and professionals are interested in changing or modifying their client's behaviors to promote access to participation in life, given the client's individual circumstances. It has been documented that people form habits related to smartphone use, which can promote formation of new behaviors, and may be of interest to professionals in rehabilitation (Peters, 2009; Wood & Neal, 2008; Oulasvirta et al., 2012).

Wood and Neal (2008) described habits as behaviors which emerge from learned associations between goal-oriented responses and triggering contexts or cues. Cues may be external or internal; external cues may include physical settings, preceding actions, specific situations, and temporal and visual stimuli, and internal cues may include emotional states and motivation (Wood & Neal, 2008).

Apps have been found to encourage consumer engagement even when the consumer has not launched the app, through use of push notifications (Xu & Zhu, 2012; Wood & Neal, 2008). Push notifications may include multimodal alerts to interact with, or "check," a given app. Upon download of the app, users who have agreed to the push notification service have permitted "third-party application servers to actively send data to their installed applications, even when the installed application is not currently running" (Xu & Zhu, 2012, pp. 11).

Wood and Neal (2008) explained that after a habit forms, a certain event or context can trigger the behavior in a highly-automatized way (Wood & Neal, 2008). Congruent with Wood and Neal's (2008) description of habit formation, push notifications serve as multimodal external cues which rely on visual, auditory, and temporal stimuli, and have been found to play a key role in reinforcement of the app-checking habit (Oulasvirta et al., 2012), and that smartphones have been found to promote habit formation (Fogg & Hreha, 2010; Peters, 2007).

Fogg and Hreha (2010) describe "quick access" rewards as intrinsic rewards within a given app which have been found to assist smartphone user escape boredom quickly, such as apps which make a user aware of interesting events and provide social activity, meanwhile, promoting the app's use, and assisting in habit formation related to that app.

A quick access reward accessed within the app must be of informational value to the user. Ways which apps have been shown to alleviate boredom quickly include entertainment through games or video (e.g., *Angry Birds, Netflix, YouTube*), social activity via use of messaging or communication apps, (e.g., *Facebook Messenger, FaceTime, Snapchat, Twitter*), or provide news (e.g. *Google News, Apple News, BBC News*) to the user. If the information provided within the app has been established as being of high informational value to the user, the user is likely to use the app at a higher frequency than apps which are of low informational value to the user, and habits form related to using that app (Oulasvirta et al., 2012). Smartphones and their applications have the potential to be habit-forming, depending on the level of interest in the content to the user.

If the informational value or reward value of an application is high, the frequency of the checking behavior increases, meaning the user is more likely to form habits related to using that app, such as checking their smartphone frequently (Xu & Zhu, 2012; Oulasvirta et al., 2012; Fogg & Hreha, 2010; Wood & Neal, 2008; Peters, 2007). This supports the notion that habits have been found to form in response to patterns in smartphone use (Oulasvirta et al., 2012; Fogg & Hreha, 2010).

Rehabilitation professionals, such as SLPs, occupational therapists (OTs), and physical therapists (PTs), aim to increase their clients' overall quality of life by adapting or modify the behaviors of their clients to support activities of daily living. Forming new behaviors is the basis of any rehabilitative profession, and existing literature has shown that smartphone applications have the potential to facilitate behavior modification (Oulasvirta et al., 2012; Fogg & Hreha, 2010) and, accessibility features have been shown to increase engagement with mobile technologies for people with disabilities (Morris, Jones, & Sweatman, 2016; Naftali & Findlater,

2014). Therefore, smartphone apps could be potentially beneficial to assist rehabilitation professionals when providing treatment to people with disabilities (Peters, 2009; Wood & Neal, 2008; Oulasvirta et al., 2012).

Use of Apps and Mobile Technologies in Rehabilitation

Mobile technologies are becoming a predominant tool in activities of daily life for all ages of people (Pew Research Center, 2018; Morris, Jones, & Sweatman, 2016; Tsetsi & Rains, 2016). Some studies have found that rehabilitative professionals, such as SLPs (Zajc et al., 2018) and OTs (Kyaio, 2015) have considered using apps for therapeutic purposes.

Zajc et al. (2018) surveyed Slovenian SLPs to explore the beliefs of SLPs toward use of tablets in speech-language therapy, to identify factors which influence the decisions of tablet-using SLPs to integrate tablets into therapy, and to determine ways in which SLPs were using tablets. Based on the responses of 72 SLPs, 90.28% of SLPs used mobile technologies for personal purposes, but only 28.3% reported use of mobile technologies for their profession (Zajc et al., 2018). Slovenian SLPs who did not use mobile technologies with apps in therapy stated that there was a lack of Slovene apps to address speech sound disorders (SSD) and that foreign-language apps had lower usability in the context of speech-language therapy. Participants from Zajc et al. (2018) who did not use apps felt that there needed to be more apps developed in the Slovene language.

Kyaio (2015) surveyed American OTs to gain information about their opinions and uses about using apps in occupational therapy. This survey generated 620 responses from practicing OTs. Of the responding OTs, 43.7% reported app use in the provision of their therapy services. OTs who used apps described them as convenient, engaging, self-reinforcing, time-saving,

accessible, and efficient for targeting multiple life skills at once (Kyaio, 2015). OTs who did not use apps in therapy reported that they did not have access to apps, they had not considered use of apps in therapy, or that they were not able to find "good apps" (Kyaio, 2015, pp. 12). In this survey, OTs working in pediatric settings were 12.59 times more likely to use apps than OTs working with adults or geriatric adults (Kyaio, 2015). Use of apps was significantly associated with use in school and outpatient settings. Respondents reported using apps to target a variety of occupational therapy goals, including activities of daily living, fine motor skills, visual perception, communication, following directions, problem-solving, and maintaining attention (Kyaio, 2015).

Using Apps to Manage Therapy Sessions

Mobile technologies are pushing into a variety of work settings where rehabilitation professionals are found, including education environments (Glackin, Rodenhiser, & Herzog, 2014; Harper & Milman, 2016) and healthcare settings (Braun et al., 2013; Kaneshige, 2011). Although the roles of OTs and SLPs differ, they share common responsibilities in both educational and healthcare settings with respect to therapy session management (e.g. data collection, documentation, implementation of assessment measures and intervention tasks, writing therapy goals, reinforcing target behaviors). OTs reported that apps were practical and useful to support their daily functions, such as documentation, behavioral reinforcement, timers, visual schedules, and collecting and tracking data (Kyaio, 2015). Within a similar workplace, SLPs may also be able to use apps for similar administrative and managerial functions as OTs.

Documentation. Mobile technologies and apps for service planning and documentation have found their way into healthcare environments such as skilled nursing facilities (SNFs), sub-acute care, acute care, and other fast-paced settings where SLPs are employed (Kaneshige,

2011). In the USA, rehabilitation companies, such as RehabCare, are integrating mobile technologies such as *Smart Mobile,* an iOS app created by Casamba a third-party developer (Apple, 2017), into therapy planning and service documentation (Kaneshige, 2011). *Smart Mobile* was designed to allow rehabilitation professionals to enter data without an internet connection. When the app syncs to an internet network server, the data from the clinician's device automatically feed into RehabCare's billing, payroll, and interconnected clinical documentation system; this has permitted therapists to access information about the patient for therapy purposes in rehabilitation settings (Kaneshige, 2011). Furthermore, a systematic review of 25 full-text articles conducted by Braun et al. (2013) investigated strengths and challenges of using mobile tools to support administration of care and patient education in healthcare settings. Braun et al. (2013) identified the most common uses of mobile technologies in healthcare settings included data collection and documentation, receiving reminders and alerts to improve follow-up with patients for past due visits, providing patient health education, and enhancing healthcare provider and client direct communication. All the functions listed (Braun et al., 2013) are responsibilities of SLPs, especially those in healthcare settings.

With the distribution of apps and mobile technologies in healthcare settings designed to assist with data collection and patient education (Braun et al., 2013; Kaneshige, 2011), privacy and confidentiality have been established as primary concerns when using mobile health applications (Jones & Moffitt, 2016). Without legitimate ethical guidelines for the development and use of mobile health applications such as *Smart Mobile*; rehabilitation therapists and other healthcare professionals must take precautions against privacy and confidentiality violations (Jones & Moffitt, 2016).

Behavioral reinforcement. In rehabilitative therapy, the therapist's goal is to encourage and create certain kinds of behaviors, to increase their occurrence, or both (Payne & Dozier, 2013). Reinforcement is a principle of operant conditioning, an empirically-based behavioral theory of learning. Positive reinforcement refers to applying a stimulus that will increase the likelihood of a behavior occurring (Payne & Dozier, 2013). The therapist presents a stimulus or antecedent and waits for a certain behavioral response. After a behaviorally appropriate response, the clinician may provide appropriate positive reinforcement (Payne & Dozier, 2013). According to the principles of positive reinforcement describe by Payne and Dozier (2013), an SLP may use an app as a reward to promote an intended behavior, if use of a specific app is rewarding to the client. For example, a clinician may agree to allow a client two minutes to go on Facebook if they sustain their attention for two therapy tasks. Therefore, the app serves as a reinforcement to encourage the desired behavior to reoccur. Additionally, there are apps which have been developed to track behavioral progress, such as *iReward,* which allows clients to earn tokens (stars) as they accomplish goals (Roth, 2013).

Time management. A timer may be used to record the length of time it takes to complete a task or to track session length. *Timer* is an app that comes within the iOS framework of all iPhones, for example (Apple, 2017). Visual timers and supports have been found to ease transitions between tasks for some clients (Huls, Anderson, Lee, & Malrony, 2017). For example, children with autism have been found to benefit from a visual timer to anticipate that change in routine is going to happen or that the topic is going to be changing (Huls et al., 2017; Roth, 2013). Individuals with intellectual disability benefit from use of visual timers in school environments and in the workplace. Visual timer apps, such as the *Visual Countdown App* (Huls et al., 2017) were developed to time the duration of tasks. Huls et al. (2017) found that the *Visual*

Countdown App can provide a cue that a transition is going to occur so that the individual can anticipate that change.

Visual schedules. A visual schedule is a behavioral intervention strategy intended to assist an individual visually organize upcoming tasks. Visual schedules have been found to assist persons with attention disorders or autism with task completion (Waters, Lerman, & Hovanetz, 2009). A variety of apps can assist the clinician with creating visual schedules (e.g., *Notes, Sticky Notes, Desk Notes, Visual Schedule Planner,* or *Whiteboard*). These apps allow the client or clinician to view the session tasks, and check off tasks after they are completed. This strategy could be used in classroom settings, vocational settings, and rehabilitation settings (Sutton, 2012).

Collecting and tracking data. To claim that progress toward a goal has been made, a professional in any rehabilitative field must keep data to track progress. There are apps such as the *Autism Tracker* and *Behavior Tracker Pro (*Walz, 2013) that can assist clinicians with documenting positive and adverse behaviors and daily routines. *Class Dojo* may be used for behavior tracking and can track progress made toward IEP goals in American public schools (Class Twist Inc., 2013). This app allows educators or SLPs to upload worksheets and visuals to the *Class Dojo* server, where the SLP can track their goal progress (Class Twist Inc., 2013). With the student's work uploaded within the app, the student can showcase their progress to parents, family, and teachers (Class Twist Inc., 2013). *Super Duper Data Tracker* and *Google Forms* can also be used to record data and notes (Walz, 2013).

Targeting Clients' Rehabilitation Goals Using App-Based Interventions

As rates of mobile technology use and ownership have been projected to rise in the USA, people who interact with apps, and clinicians who integrate apps into therapy, should know about the potential benefits which accompany smartphone and app use in children, adolescents, and adults. In this paper, both therapy-focused apps and mainstream apps are discussed in the contexts of physical, occupational, and speech-language therapy. Therapy-focused apps are apps which were developed for the purpose of targeting a therapy goal. There are also mainstream apps which were not developed specifically for therapeutic purposes, but may still be manipulated by a skilled clinician to target a skill area. There are a variety of both therapy-focused apps and mainstream apps available in app marketplaces. Both classes of applications may allow for skill practice and maintenance of physical therapy, occupational therapy, and speech-language therapy goals, given that the therapist uses them appropriately and that the client shows progress under provision of the apps' therapeutic use.

Such potential benefits of integrating app use into the practices of rehabilitation therapists have been established in physical therapy (Paul et al., 2016), occupational therapy (Kizony, Zeilig, Dudkiewicz, Schejter-Margalit, & Rand, 2016), and speech-language therapy (Neumann, 2017; Schoen-Simmons, Paul, & Shic, 2016; Stone-MacDonald, 2014), and are presented in the following sections.

Physical therapy. Physical therapists determine where restraint of a movement occurs due to an illness or injury; focus on improving movements of the human body; use exercise therapy and other therapeutic techniques to ease pain; promote mobility and muscle strength; and take part in prevention of new injuries (American Physical Therapy Association, 2017).

Some sources of existing literature have found that certain apps promote functional behaviors in physical therapy patients. Researchers in physical therapy and rehabilitation have found that apps may assist in establishing new, functional behaviors for individuals after a stroke (Paul et al., 2016). Paul et al. (2016) conducted a pilot efficacy study to determine if *STARFISH*, an app, could promote functional behaviors in individuals who have experienced a stroke. The app was designed to support functional behaviors, while providing feedback, self-monitoring, and promoting high quality of life in individuals who have experienced a stroke (Paul et al., 2016). The app was trialed with 23 people between 46 and 66 years old who had had strokes. The app was found to improved rates of physical activity in all participants (Paul et al., 2016).

Occupational therapy. Occupational therapists assist individuals of all ages to participate in everyday activities. OTs help people function in occupations, or everyday activities, across environments (American Occupational Therapy Association, 2017). Professionals in this field address a variety of goals related to increasing participation in functional, daily occupations for clients. According to Kyaio (2015), many, but not all OTs have been found to target occupational therapy goals by integrating apps into treatment. OT goals may target a range of areas including functional vision skills (e.g., tracking, visual scanning), fine motor skills (e.g., speed, agility, and coordination), and cognitive skills (e.g., visual memory, attention, sequencing) (American Occupational Therapy Association, 2017).

OTs may desire to integrate apps into therapy since planning and execution of motor movements is required to interact with them (Kizony et al., 2016). For example, Kizony et al. (2016) investigated the use of tablets to improve hand dexterity impairments in individuals who have had strokes. Kizony et al. (2016) found that the app-based interventions used in the study were efficacious in persons with hand dexterity impairments after having a stroke, and may have

future potential for facilitating independent, self-trained exercises in apps that isolate the targeted movements for the patient.

Although apps and mobile technologies may be appealing to use to target occupational therapy goals, evidence related to mobile device implementation in the context of occupational therapy is limited (Erickson, 2015), yet OTs have self-reported that they use them to target client therapy goals (Kyaio, 2015). Erickson (2015) wrote a research article which advocated for the importance for OTs to use evidence to guide clinical decisions regarding app use. The article identified client and clinician factors to consider when using smartphones and tablets in the context of occupational therapy (Erickson, 2015). As a guideline, Erickson (2015) encouraged occupational therapist to consider client-related factors, such as client performance skills, context and environment (e.g. social attitudes, cultural priorities), activity demands, and device features, as well as factors related to the OT, including consideration of evidence, such as American Occupational Therapy Association (AOTA) resources or research, legislative and financial structures (e.g., OT's scope of practice, financial incentives), and knowledge, education, and competence (e.g. continuing education and cultivating basic knowledge and skills to implement technology when appropriate) (Erickson, 2015).

Again, Kyaio (2015) conducted a survey of practicing OTs and reported that 47.3% of OTs at that time were integrating apps into their clinical practice. When considering which apps to purchase and use in therapy, 35.5% of OTs who were app users referred to the AOTA, while 65.3% sought out recommendations from peers (Kyaio, 2015). OTs who responded to the survey that they did not use apps indicated that the primary reason was they had difficulty finding appropriate apps. The OTs felt that researching apps can be time-consuming. Since 2015, evidence has found that apps have been implemented by OTs to target occupational therapy

goals (Kyaio, 2015), but there are very few efficacy studies available (Erikson, 2015). OTs, especially those who worked in schools, skilled nursing facilities, or outpatient facilities at the time of the survey, were more likely to ask a colleague for app recommendations than to seek out evidence-based research (Kyaio, 2015). Kyaio (2015) also advocated for future research related to efficacy studies to verify the effectiveness of apps, and guidelines to assist OTs in making app-related decisions for therapy purposes.

Speech-Language pathology. SLPs are responsible for treatment of clients with communication and swallowing disorders. It is the clinician's responsibility to choose therapy materials based on the client's needs and characteristics (ASHA, 2010). There are a variety of scholarly articles, blogs, and informal resources which have been made available to SLPs that have listed apps intended to target therapy goals (Gosnell, 2011). These include apps to target language and literacy goals for pediatric populations (Maginnis-Kuster, 2018, Marsh et al., 2015, Artemenko, 2014), apps to target social communication skills in individuals with Autism (Oien, 2014), apps to target cognition goals for individuals with traumatic brain injury (Sutton, 2012) or early dementia (Kong, 2015), and apps to improve clarity and word understanding in older adults (Lesner & Klingler, 2011). There are a variety of therapy-focused apps which have been developed with the intention to target the breadth of skill areas encompassed in the expanding scope of practice of speech-language pathology, yet the research to back the efficacy of these apps is limited.

For example, Newmann (2017) compared the use of tablets and apps in enhancement of emergent literacy skills in a group of 24 typically developing children (age 2;0-5;0 years) to a control group of 24 age-matched children. Children in the control condition did not receive any tablet or iPad exposure or tablet-based classroom instruction. The control group participated in

activities (e.g. blocks, puzzles, painting, sand play) with regular teachers and shared storybook reading (Newmann, 2017). The children in the experimental group participated in classroom activities but received 30 minutes of iPad based therapy a week for nine weeks. The control group showed improvement in letter name and sound knowledge, print concepts, and name writing skills (Newmann, 2017). The children who did not receive the iPad-based intervention did not show significant improvement in those skills within the nine-week period. All of the children in the study were typically developing children from middle-class backgrounds and they did not receive a comparison intervention (Newmann, 2017). These aspects make it very difficult for SLPs to generalize the findings of the study to other populations, especially populations with identified speech, language, or literacy impairments.

Schoen-Simmons, Paul, and Shic (2016) conducted a study to determine the efficacy of *SpeechPrompts*, an app designed to treat prosodic deficits in individuals with Autism Spectrum Disorder (ASD) and other communication impairments. Overall, the app-based intervention was found to be effective in the forty students from five years old to 19 years old who participated in the study (Schoen-Simmons, Paul, & Shic, 2016). From the sample, 67.5% of participants were identified with ASD; the remaining 32.5% of the participants had prosodic impairments related to other diagnoses including speech and language impairment, intellectual disability, traumatic brain injury, multiple disabilities, or other health impairments (Schoen-Simmons, Paul, & Shic, 2016). The SLPs in the study worked across preschool, elementary, middle, and high school settings, and had varying years of treatment experience. Sixty percent of the SLPs had significant experience working with tablets and iPads (Schoen-Simmons, Paul, & Shic, 2016). Although app based intervention was effective in treatment of prosodic impairment in students with communication disorders, limitations disclosed by the investigators included that there was an in

inconsistency in dosages and intensity of treatment, no control group was identified in the investigation, and no comparison therapies were available to compare and contrast therapy techniques (Schoen-Simmons, Paul, & Shic, 2016). Although the app-based intervention improved the prosody in individuals identified with prosodic disorders, the evidence was not solid enough to affirm that this prosodic intervention app leads to similar or better results than traditional prosody interventions. Further research is warranted (Schoen-Simmons, Paul, & Shic, 2016).

Additionally, Stone-MacDonald (2014) investigated the use of iPad apps to increase literacy and communication skills in one 5-year-old student with ASD and complex communication needs (Stone-MacDonald, 2014). The iPad was also used as an AAC device. This study found that the child made progress in both literacy and communication skills within a year. This was a case study design experiments. Although case studies are valid and useful at times, they are considered to be a weaker form of evidence because it is hard to generalize the experience of just one client or clinician to the experience of a group of people.

Limitations of Current Efficacy Studies

There are inconsistencies in the ways which the efficacy of app-based interventions have been investigated. Some examples did not include control groups (Shoen-Simmons, Paul, & Shic, 2016), had limited sample sizes (Shoen-Simmons, Paul, & Shic, 2016; Stone-MacDonald, 2014), did not have a non-app comparison intervention equivalent in content (Newmann, 2017), or did not use participants with true speech and language disorders (Newmann, 2017). There is a critical need for individual randomized controlled trials and systematic reviews of randomized controlled trials of app-based interventions, especially since app developers have already designed therapy-focused apps available for download within both the Apple App Store and

Google Play Store (Maginnis-Kuster, 2018; Kong, 2015, Oien, 2014; Gosnell, 2011). For example, Oien (2014) lists over 200 apps for improving communication, behavior, and social skills in individuals with ASD.

Pioneers in rehabilitation and education-based disciplines have recognized that there are very many apps available for download, but not enough efficacy studies to support their use in. For example, Papadakis, Kalogiannakis, and Zaranis (2017b) conducted a systematic review of educational apps within the Android Google Play store for Greek preschoolers. This systematic review identified common themes related to limitations in existing app-efficacy literature, stating that despite the abundance of apps available for download, high-quality educational apps are hard to identify and find (Papadakis, Kalogiannakis, & Zaranis, 2017b). The same article also stated that a variety of educational apps that were available did not truly meet the developmental needs of the preschool population, and stated that there is a lack of a reliable and effective framework for evaluating mobile technology, apps, and other related content (Papadakis, Kalogiannakis, & Zaranis, 2017b).

There are very few systematic reviews of apps for educational use in existing literature (Papadakis, Kalogiannakis, & Zaranis, 2017b; Cherner et al., 2016). Both of these studies found that despite the overabundance of available applications on the app market, high-quality educational apps are hard to identify and find, a variety of educational apps available do not truly meet the developmental needs of the preschool population, and there is a lack of a reliable and effective framework for evaluating mobile technology, apps, and other related content (Papadakis, Kalogiannakis, & Zaranis, 2017b; Cherner et al., 2016).

Overall, inadequate research designs and an overabundance of limitations have been superimposed upon a variety of research studies that have claimed that an app has been found to

be an effective treatment or educational tool for SLPs or OTs to use (Newmann, 2017; Papadakis, Kalogiannakis, & Zaranis, 2017b; Schoen-Simmons, Paul, & Shic, 2016; Erickson, 2015; Stone-MacDonald, 2014). Therefore, it is difficult to make any affirmative conclusions about the efficacy of apps which have been developed with the intention to target speech-language therapy goals.

Rationale for Current Study

Therapists in other rehabilitative professions are beginning to show an interest in using apps to target therapy goals (Erickson, 2015; Kyaio, 2015). In addition, app-based therapy practices have piqued the interests of SLPs outside of the USA (Zajc et al., 2018) and future SLPs enrolled in Master's programs in the USA (Munoz, Brimo, & Hoffman, 2013). There is an obvious gap in the literature supporting the efficacy of said apps as evidence-based interventions, not only in the field of speech-language pathology (Zajc et al., 2018; Papadakis, Kalogiannakis, & Zaranis, 2017b.; Munoz, Hoffman, & Brimo, 2013) but also in occupational therapy as well (Erickson, 2015). At this time, little is known about the practice patterns and attitudes of SLPs toward app-based practices. This study aims to identify the opinions and attitudes of SLPs toward using apps in therapy. Given the limited efficacy research about apps, it is important to know if SLPs are using them, and if so, for what purposes.

Research Questions

Existing literature in the field of Speech-Language Pathology has not yet explored the opinions and attitudes of SLPs toward use of apps and mobile technologies in therapy. This project aims to answer the following research questions:

1. What are the characteristics of SLPs who use apps in therapy?
2. For what purposes are apps currently used? What skills do SLPs target when using apps?
3. What barriers do SLPs face when using apps?
4. What factors do SLPs consider when purchasing apps?

METHODS

Materials

This study used a web-based survey to answer the research questions about the attitudes and opinions of current SLPs who do and do not incorporate apps into speech-language therapy sessions. The study was implemented using the Qualtrics (Qualtrics LLC, Provo, Utah) survey platform. Qualtrics is an internet-based platform used for delivering questionnaires and collecting participant responses. The computerized delivery method allows for use of skip patterns so participants are only shown questions that pertain to their responses. An online survey design requires internet access, a device to access the internet, and operational competence of the device chosen (Dillman, Smyth & Christian, 2014). An online survey design was selected on the basis that participants of the survey belonged to demographic groups that were likely to have internet service, either on a personal computer or device, or a device provided by their work setting.

Survey Development

The web-based survey consisting of 48 questions is presented in Appendix A. Questions addressed demographic data regarding the SLP completing the survey and general demographic data about their clients. The questions in the survey were designed to investigate if SLPs from different demographic backgrounds were using apps, the settings of practice in which apps are used, purposes of apps that are valuable to SLPs and their clients, factors which SLPs consider when purchasing apps, and barriers to app use experienced by non-app using SLPs.

The survey questions were developed using strategies described by Dillman, Smyth, and Christian (2014). Strategies included the use of simple language, closed-ended and open-ended questions. All survey questions were written in simple language. Some terms used were not

layman's terms, such as "compensatory aids," "plan of care documentation," or "augmentative communication systems", but these were commonplace for the participating professionals. The experimenters asked open-ended and closed-ended questions when collecting factual data related to demographic features of SLPs and their clients.

The majority of questions were written in the form of multiple choice with the option to select "other" and fill in the necessary response. "Other" responses were designed to permit freedom of unanticipated or uncommon responses when appropriate. Use of a closed-ended question without the "other" option as an opportunity to elaborate with a written response risks placing limits on the accuracy of responses in circumstances which the participant's desired response is not offered (Dillman, Smyth & Christian, 2014).

Survey Validation

To ensure that the survey questions were appropriate for answering the research questions of the study, three experts in communication sciences and disorders reviewed the survey. The experts provided feedback about the content of the survey, question wording, and survey organization. The suggestions from the experts were used to revise the survey prior to its distribution.

Participants

Recruitment

Participants were recruited through a variety of methods, including posts on the ASHA online community, posts to SLP groups on Facebook, and email messages. Emails were sent to alumni of the University of Wisconsin-Milwaukee Communication Sciences and Disorders program and community-based externship supervisors in the greater Milwaukee area. Links to

the internet-based survey were also be sent via email to known SLPs by faculty, staff, students, and alumni at UW-Milwaukee. Participating SLPs were encouraged to share the survey with other SLP colleagues on a voluntary, non-incentivized basis.

Posts were made to ASHA community forums on Autism, Early Intervention, Early-Career Professionals, Research, SLPs in Health Care, SLPs in Private Practice, and SLPs in Schools. Posts were also made to the following ASHA Special Interest Group web discussion boards: Language Learning and Education, Neurogenic Speech and Language Disorders, Voice and Voice Disorders, Fluency Disorders, Augmentative and Alternative Communication, and Swallowing and Swallowing Disorders. Public postings were also made to special interest groups on Facebook related to speech-language pathology, including Facebook pages related to University of Wisconsin-Milwaukee Department of Communication Sciences and Disorders, and other available speech-language pathology-related groups. All posts and emails included a brief description of the study and a link to the consent form and online survey.

Participant Characteristics

Participants in the present survey included SLPs who have earned at least a Master's degree and had their certificate of clinical competence (CCC-SLP), or were currently in their clinical fellowship year (CFY-SLP). All individuals who participated in the survey had access to a computer or mobile technology with internet access to participate because the survey and recruitment for the survey were internet-based. All participants resided in the United States of America. The survey was only offered in English; therefore participants were either proficient in English or were required to take the survey accompanied by an interpreter or to use an internet translation service. Individuals who were not SLPs, or had not completed a Master's degree or

higher were excluded from the study. Data from participants who initiated the survey, but did not complete the survey questions about app use were excluded from the analysis.

Qualtrics recorded 242 individuals who accessed the survey. Two individuals declined to participate by not signing the consent form. Two participant responses were excluded from analysis because they were not CCC-SLP or CFY-SLP. Five responses were incomplete, meaning the participants did not complete the survey in its entirety and were excluded from analyses.

The analyses are based on responses from 228 SLPs in the entire sample. The mean (*M)* age of participants was 43.23 years of age with a range 24;0 to 71;0 years. The participants had an average of 16.68 years of experience as SLPs (range one month to 47 years). Nine participants were male, 218 participants were female, and 1 participant identified as other gender. Only nine out of 228 total participants indicated they did not use personal smartphone devices.

Statistical Analysis

The results of the survey were analyzed using descriptive statistics, parametric analyses, and non-parametric analyses. The descriptive statistics used included description of data using proportions, *Ms,* and standard deviations (*SDs)*. Parametric analyses used were independent-samples *t* tests. Non-parametric analyses used were Pearson's Chi-Square analysis. An a priori (*p*-value) of 0.05 was established to determine statistical significance in the subsequent analyses.

RESULTS

The results are presented according to the original research questions to (1) examine common trends in demographic features of SLPs who use apps in therapy, (2) examine the

purposes for which apps are currently used and which skills SLPs target when using apps in therapy, (3) examine the variety of barriers which SLPs may face when using apps or mobile technologies in therapy, and (4) examine the factors which SLPs consider when purchasing apps.

What Are the Characteristics of SLPs Who Use Apps in Therapy?

Descriptive statistics (*M*, *SD*, and range) were used to describe the age, gender, years of treatment experience, primary treatment population, and work settings of the SLPs who responded that they used apps in therapy. There were 228 participating SLPs in the entire sample. Within the population sampled, there was a higher count of overall app users (n = 184) than those who did not use apps in therapy (n = 44). The *M* age of those who used apps was 43.28 years; the *M* age of those who did not use apps was 43.02 years. The *M* years of experience of SLP app users was 16.92 years; the *M* years of experience of non-app users was 15.57 years. Years practicing of the participants ranged from one month of experience to 47 years of practicing. Table 3 summarizes the descriptive statistics, including number of respondents in the sample (*N*), subsample (n), the *M*, and range.

Table 3.

Descriptive Statistics of Continuous Demographic Features of the Sample, Including Age in Years and Years of Treatment Experience

	Used Apps			**Did not use Apps**			**Total**		
	n	*M*	Range	*n*	*M*	range	*N*	*M*	range
Age in Years	182	43.23	24-71	42	43.02	26-69	224	43.23	24-71
Years of Experience	184	16.92	1-47	43	15.57	.08-44	227	16.67	.08-47

Independent-samples *t*-tests were conducted to evaluate whether differences in age and years practicing existed between the app and non-app users. No significant differences were observed for age $t(222) = .11$, $p = .91$; or years of practice $t(225) =. 62$, $p = .53$.

Nine males, 218 females, and one individual who identified as "other" participated in the study. Seven (78%) of the male participants, 176 (81%) of the female participants, and one (100%) of individuals who identified as "other" used apps. Table 4 summarizes app use by SLPs by gender. The distribution of participants by gender is presented in Table 4. Seven males reported using apps while two reported that they did not use apps. 176 females who participated in the survey used apps and 42 did not. The individual who identified as "other" reported that they used apps. Pearson's chi-square statistic was employed to examine whether gender affected the determination of the SLP to use apps. There was no statistically significant difference in the gender distribution and the likelihood that the participant used apps (X^2=.29, n = 228, df = 2, p =.87).

The primary treatment populations of the participants in this study included pediatric populations (n = 148) and adult populations (n = 80). Table 5 summarizes app use by SLPs who

work with pediatric and adult treatment populations. Table 6 presents a frequency distribution of the primary treatment settings in which app-using SLPs and non-app using SLPs work. Pearson's chi-square statistic was employed to examine whether primary treatment population affected the determination of the SLP to use apps. There was no significant relationship between tendency to use apps and treatment population ($X^2 = 1.57$, $n = 228$, $df = 1$, $p = .210$).

Table 4.

Gender of SLPs who Reported Using Apps or not Using Apps for Therapy-Related Purposes

	Used Apps	**Did not use Apps**	**Total**
Male	7	2	9
Female	176	42	218
Other	1	0	1

Table 5.

Number of SLPs Working with Pediatric and Adult Populations who Reported Using Apps or not Using Apps for Therapy-Related Purposes

Primary Treatment Population	**Used Apps**	**Did not use Apps**	**Total**
Pediatric	123	25	148
Adult	61	19	80
Total	184	44	228

Table 6.

Number of SLPs who Reported Using Apps or not Using Apps for Therapy-Related Purposes by Primary Treatment Setting

		Used Apps	Did not use Apps	Total SLPs
Primary Treatment Setting	Early Intervention	7	6	13
	Elementary School	52	6	58
	Middle School	10	1	11
	High School	3	1	4
	Acute	10	9	19
	Subacute	5	0	5
	Inpatient Rehabilitation	7	1	8
	Outpatient Rehabilitation	27	7	34
	Skilled Nursing Facility	16	3	19
	Private Practice	17	2	19
	In-Home Care	5	2	7
	Telepractice	1	0	1
	Aural Rehabilitation	1	0	1
	University	12	3	15
	Other (Please Describe)	11	3	14
Total		184	44	228

For What Purposes Are Apps Currently Used? What Skills Do SLPs Target When Using Apps?

Frequency distributions were calculated for the responses regarding the purpose for which apps are being used by participants who use apps in therapy. The list of possible purposes of app use were based on the list of purposes from Kyaio (2015) and integrated with practical

purposes for SLPs. The participants reported a variety of purposes for which they used apps in their provision of speech-language therapy services. The participants selected all of the purposes that they used apps from a list of nine options. An "other" option was available for any purposes for which apps are used but were not listed. The response options represented two categories of purposes, directly targeting therapy goal and skill development, and managing the therapy session and supporting administrative tasks. Table 7 presents the responses from the number of participants who reported that they used apps. The participants were permitted to select more than one response; therefore, the sum of the percentages in the table is greater than 100%. SLPs who reported they used apps for therapy-related purposes were most likely to use apps to directly target therapy goals and skill development (90.22%). Apps were also commonly used as homework (54.35%), behavioral reinforcement, (46.74%), visual schedules (43.84%), and compensatory aids (41.85%). Participants reported "other" purposes for using apps, including uses related to AAC (6.52%); video modeling (2.17%); educational purposes for patients, students, or their families (2.72%); creating or displaying audiovisual materials (2.17%); motivation (1.09%); biofeedback such as sound level meter (1.09%); billing software (0.54%); assessment (0.54%); and home or community engagement (0.54%).

Table 7.

Purposes for Using Apps Reported by App-Using SLPs

Category	Purpose	# of respondents	% of respondents
For Directly Targeting Therapy Goal and Skill Development	To Target Therapy Goals	166	90.22%
	Homework	100	54.35%
For Managing the Therapy Session and Supporting Administrative Tasks	Behavioral Reinforcement	86	46.74%
	Visual Schedules	80	43.48%
	Compensatory Aids	77	41.85%
	Other	47	25.54%
	Documentation	36	19.57%
	Time Management	34	18.48%
	Measuring Progress	7	3.80%

More than 90% of the participants who used apps reported that they used them to target therapy goals. These participants were asked to further specify which goals or skills they targeted when using apps in therapy. The available response options can be found in Table 8, which is organized by (1) general goal/skill area targeted, (2) number of respondents, and (3) proportion of respondents. The most common goal areas targeted by participating SLPs included expressive and receptive language (77.72%), speech sound production (69.02%), and problem-solving (48.91%). Other goal areas targeted by SLPs included attention (42.39%), memory (41.30%), voice or resonance (27.17%), fluency (20.65%), swallowing (16.30%), hearing (2.72%), and other (11.41%). Other goal areas SLPs used apps to target included social skills (2.17%), AAC (3.80%), executive functions (1.09%), attention (0.54%), cause and effect (0.54%), monitoring speaking volume (0.54%), and speech intelligibility (0.54%).

Table 8.

General Goal Areas which SLPs use Apps to Target

General Goal Area Targeted	# of Respondents	% of Respondents
Expressive & Receptive Language	143	77.72%
Speech Sound Production	127	69.02%
Problem-Solving	90	48.91%
Attention	78	42.39%
Memory	76	41.30%
Voice or Resonance	50	27.17%
Fluency	38	20.65%
Swallowing	30	16.30%
Other	21	11.41%
Hearing	5	2.72%

What Barriers Do SLPs Face When Using Apps?

To determine the amount of users who did not use apps, the survey asked the following yes/no question: "Do you use apps for therapy-related purposes such as targeting therapy goals, compensatory aids, visual schedules, visual timer, and may also include data taking, or plan of care documentation (e.g. daily notes, progress notes, and other related documents) within an app? This does not include using apps as augmentative communication systems." Only 44 respondents reported that they did not use apps for therapy related purposes. Barriers which prevented SLPs from using apps for therapy-related purposes included "I prefer other therapy materials" (40.91%), "I must use a personal device if I want to use apps in therapy" (20.45%), and "not functional for client to use" (20.45%). Additional responses included "limited budget at work" (18.18%), "apps are distracting to clients" (18.18%), "there are not enough devices to share at work" (15.91%), "clients or caregivers do not support use of apps in therapy" (11.36%), "I didn't know about apps" (11.36%), "access limitations" (11.36%), "primary work setting

does not permit use of mobile technologies for therapy" (4.55%), "never considered" (4.55%), and "no internet access at work" (0.00%).

Fifty percent (50.00%) of the respondents indicated that there were other barriers preventing their use of apps in therapy. These responses included limited relevance to SLP's setting (9.09%), clients are already overexposed to screens at home and in other naturalistic settings (9.09%), and using apps takes away from goal progress related to interaction between the client and others (6.81%). Other responses in which only 1 participant out of 44 responded (2.27%) included that apps were not available in other languages than English, using apps in therapy cannot be justified as a skilled and billable service for Medicare reimbursement, the technology is fragile and can be easily broken, clients become fixated on app use hindering transition to non-app based activities, not enough research is available to prove the efficacy of apps, and after trialing apps did not find them to promote goal progress as well as other traditional interventions.

To examine the variety of barriers SLPs may face in using apps with clients, please refer to Table 9. Data table organization follows barrier type, number of recorded responses, and frequency.

Table 9.

Barriers to App Use Reported by SLPs who Do Not use Apps

Barrier selected by participant	# of recorded responses	% of participant responses
Other	22	50.00%
I prefer other therapy materials	18	40.91%
I must use a personal device if I want to use apps in therapy	9	20.45%
Not functional for client to use	9	20.45%
Limited budget at work	8	18.18%
Apps are distracting to clients	8	18.18%
There are not enough devices to share at work	7	15.91%
Clients or their caregivers do not support use of apps in therapy	5	11.36%
I did not know that therapy apps were out there and I would like to learn more	5	11.36%
My clients have disabilities which prevent them from using devices	5	11.36%
Primary work setting does not permit use of mobile technologies for therapy	2	4.55%
Never considered	2	4.55%
No internet access at work	0	0.00%

What factors do SLPs consider when purchasing apps?

The present survey also examined factors which SLPs consider when purchasing an app. The response options presented in the survey were based on the study by Kyaio (2015) investigating OTs use of apps. The responses were adapted to include options that would be appropriate for SLPs. The SLP was allowed to select as many of the provided listed purchasing factors as they desired. To determine what factors SLPs considered when purchasing apps, the experimenters tabulated responses to the corresponding survey question from respondents who did used apps (n = 184), listed in Table 10. The four most popular responses which SLPs who used apps selected included consideration of the client's goals (75%), consulting colleagues for app recommendations (69.57%), considering the price of the app (67.39%), and the client's

demographic features, such as age and gender (63.04%). Additional responses included reading reviews in the app store (41.30%), consulting ASHA resources (30.98%), consulting research such as scholarly articles (30.98%), and search results in the app store (26.63%). Response frequencies are reported for each factor listed in the survey. The experimenters calculated the proportion of respondents who used apps, used a frequency distribution to analyze the frequency of each type of outcome, and calculated the portion of the sample which reported the purchasing factor. Table 10 is organized by 1) attribute, 2) frequency, and 3) portion of sample.

Table 10.

Purchasing Factors Considered by SLPs who Reported Using Apps

Purchasing Factor	Frequency	Proportion of Respondents
Client Goals	138	75.00%
Colleagues	128	69.57%
Price of App	124	67.39%
Demographic Features of Client	116	63.04%
Reviews in App Store	76	41.30%
ASHA	68	36.96%
Research	57	30.98%
Search Results	49	26.63%

DISCUSSION

The present study was conducted to determine the current practices of SLPs, both CCC-SLPs and CFY-SLPs, regarding app use in speech-language therapy. This survey-based investigation included the perspectives of both SLPs who employed apps in therapy and SLPs who did not use apps in therapy. The purpose of the study was to examine changes in practice patterns relative to the rapid surge of apps and mobile technologies. The discussion points are presented according to the original research questions to (1) examine common trends in demographic features of SLPs who use apps in therapy, (2) examine the purposes for which apps

are currently used and which skills SLPs target when using apps in therapy, (3) examine the variety of barriers which SLPs may face when using apps or mobile technologies in therapy, and (3) examine the factors which SLPs consider when purchasing apps.

Use of Apps by SLPs

The results of the internet-based survey indicated that many SLPs, especially SLPs in pediatric settings, are employing app use in the provision of their speech-language therapy services (*n* =184, 81%). The results of this study supported the findings of both Zajc et al. (2018) and Kyaio (2015), who found that not all SLPs and OTs are incorporating apps into practice, but many are. According to Kyaio (2015), 43% of the surveyed OTs were using apps, yet almost twice as many of the SLPs surveyed in the current investigation (81%) reported that they used apps for speech-language therapy related tasks. The differences between the present study and that conducted by Kyaio (2015) may indicate actual differences in practice patterns between SLPs and OTs or they may reflect the overall increase of apps available in the marketplace in the three years since the publication of the Kyaio (2015) study. The number of apps available within the Apple App Store grew from 350,000 in 2011 (Morris & Mueller, 2014) to 2.2 million mobile apps in 2017 (Statista, 2018; Apple, 2017). The number of available apps from the Google Play Store in 2018 was 3.3 million. (Statista, 2018), and 49% of American smartphone users download apps monthly (comScore, 2017). Therefore, the difference in the number of professionals using apps may just be a reflection of national trends regarding mobile technologies.

Similar to Kayio (2015), more SLPs working with children responded to the present survey than SLPs working with adults. This may be indicative of the trend that tablet-based app use has been found to be prevalent in a variety of education settings from K-12 in the USA

(Harper & Milman, 2016), and globally (Richardson et al., 2013). Young children, school-aged children, and adolescents are engaging with apps and mobile technologies often (American Academy of Pediatrics, 2016a; American Academy of Pediatrics, 2016b; Reid-Chassiakos et al., 2016; Kabali et al., 2015), for both academic uses (Harper & Milman, 2016, Richardson et al., 2013) and for personal use (Cha & Seo, 2018).

With the influx of apps and mobile technologies present in schools, healthcare settings, and workplaces, SLPs, rehabilitation professionals, educators, and other professionals should recognize that there are evidence-based benefits identified from use of digital media, which include apps and *YouTube* videos (Reid-Chassiakos et al., 2016), and evidence-based risks which are associated with overexposure to screens (e.g. TV, tablet, smartphone, or other technology-based screens) (Reid-Chassiakos et al., 2016, Cha & Seo, 2018).

In pediatric populations, evidence-based benefits have been cognitive in nature, including new learning and exposure to ideas and knowledge, increased opportunities to socialize, and new opportunities to access health educational resources (Reid-Chassiakos et al., 2016; Kabali et al., 2015). Evidence-based risks associated to exposure to apps and *YouTube* for school-aged and adolescents include changes in attention and learning behaviors, poor sleep, obesity and depression, and exposure to "inaccurate, inappropriate, or unsafe content and contacts" (Reid-Chassiakos et al., 2016, pp.1). Additional empirical evidence has been shown to support overexposure to screen time and poor sleep outcomes in children ages 6;0-15;0 diagnosed with developmental disabilities (Aishworiya, Kiing, Chan, Tung et al., 2018). Aishworiya et al. (2018) surveyed 102 parents of children with developmental disorders. The parents completed a questionnaire related to their child's sleep patterns and screen time. The investigators found that greater daily screen time was associated with less sleep (Aishworiya et al., 2018).

Another risk of mobile technology and app use is smartphone addiction, a risk for both children and adults. A study conducted by Cha and Seo (2018) investigated patterns of smartphone use and addiction in South Korean adolescents, ages 14.82 years to 16.38 years old. Cha and Seo (2018) defined smartphone addiction as "the inability to control the smartphone use despite negative effects on users" (Cha & Seo, 2018, pp. 2). The *Smartphone Addiction Proneness Scale* (Kim, Lee, Lee, & Nam et al., 2014) was used to identify normal smartphone users and smartphone users at risk for addiction, and approximately 31% of the sample were at risk for smartphone addiction (Cha & Seo, 2018). Although gender, family income, or parent's education did not predict smartphone addiction, smartphone behaviors predicted smartphone addiction. Participants in the at-risk group for smartphone addiction spent more time on mobile messenger apps and social networking services than the participants who were not at risk for smartphone addiction (Cha & Seo, 2018).

Cha and Seo also reported behavioral symptoms which accompany smartphone addiction, which were found to be psychological and physical in nature. Psychological symptoms included depression and anxiety (Cha & Seo, 2018). Physical symptoms related to smartphone overuse were described in the background of Cha and Seo (2018)'s article and included "cancer, brain tumor, nervous disturbances, weakening of the immune system, problems with the eardrum, pain in the wrist, neck, and joints, fatigue, and sleep disorders" (Cha & Seo, 2018, pp. 4).

The findings from Cha and Seo (2018) should be of relative interest to persons in the USA, since South Koreans have higher rates of smartphone ownership and rates of ownership in the USA are projected to increase in the future (Pew Research Center, 2018). Globally, a comparison of 40 nations established South Korea as having the highest rate of smartphone ownership, with 88% of South Koreans owning smartphones in 2015 (Cha & Seo, 2018),

exceeding rates of smartphone ownership in the USA in February of 2018 (Pew Research Center, 2018).

For adults, mobile technologies used for work purposes have been associated with increased autonomy, boosted productivity, enhanced professional relationships, and efficient access to data in the workplace (Fenwick & Edwards, 2016). In the same vein, Braun et al. (2013) identified that mobile technologies and apps supported data collection, documentation, reminders for job-related duties, and communication with clients and other professionals. All the functions listed (Braun et al., 2013) are responsibilities of SLPs, especially those in healthcare settings. Despite potential benefits, smartphone addiction is also a problem for adults. Data revealed by Duke and Montag (2017) suggest that adults who are addicted to their smartphones are less productive at work and at home. Participants who were addicted to their smartphones spent fewer minutes working without interruption and lost more work hours to smartphone use. Smartphone addicted adults also tended to engage with their smartphone on the job, despite their awareness that the use of their smartphone had negative effects on workplace productivity (Duke & Montag, 2017).

Characteristics of SLPs Who Use Apps

The current study data represented responses from SLPs across 20 diverse treatment settings. The demographic traits and features of SLPs utilizing apps in therapy, including the clinician's age, the clinician's years of treatment experience, primary treatment setting, and age of primary treatment population, did not significantly differ between those who used apps and those who did not. Considering the data retrieved from Pew Research Center (2018), the investigators predicted that there would have been some demographic differences among age of app-using SLPs and non-app using SLPs. The pool of participants in the current study do not

follow the trends of the Pew Research Center (2018) data. Only nine out of 228 total participants indicated that they did not use personal smartphone devices, and none of the non-app using SLPs reported that they did not have internet access at work.

Given the preponderance of pediatric, app-using SLPs who responded to the survey, the demographic data presented may be more of a description of who took the survey than the overall population of those who use apps versus those who do not use apps in the context of speech-language therapy services.

Purposes for Using Apps

Nearly 90% of the surveyed app-using SLPs reported that they used apps to directly target therapy goals. The goals which were reportedly targeted most often by SLPs using apps were related to expressive and receptive language, speech sound production (e.g. articulation, phonology, motor speech disorders), and problem solving skills. Goals in the areas of speech sound production, expressive and receptive language, are represented in both pediatric and adult settings; therefore, it is not surprising that these were the most common treatment areas reported. This trend may also reflect the rates of participation from pediatric SLPs in the survey. The most common skill areas reported are commonly found in pediatric settings, such as schools (ASHA, 2018). Given the high rate of SLPs who reported using apps to target therapy goals, it is imperative that efficacy studies are performed to validate the use of apps intended to improve targeted speech-language therapy skills.

Barriers to Using Apps

Beukelman and Mirenda (2013) defined barrier types which correspond to the participation model, a tool used by SLPs, to identify extrinsic and intrinsic barriers to use of

AAC. The participation model is an accurate infographic frequently used during assessment for an individual who uses AAC. A multitude of these barriers reflect the clinician's preferences, knowledge, skills, and willingness to AAC, considered a type of technology (Beukelman & Mirenda, 2013). Because apps are a type of technology, the investigators thought that factors similar to those affecting the use of AAC may also play a role in the adoption of apps in therapy.

We adapted the extrinsic and intrinsic barriers defined by Beukelman and Mirenda (2013) to describe the barrier types which SLPs may face when trying to implement apps. In the context of this investigation, participants encountered policy and practice barriers, attitude barriers, knowledge barriers, skill barriers, and access barriers.

Policy barriers included barriers which prevented the use of app-based interventions due to a legislation, policy, or regulation. Practice barriers are similar to policy barriers, but no specific policy or regulation exists to prevent someone from using apps; rather they are barriers due to conventional practice. Some of these barriers included a limited budget at work (18.18%), limitations at the SLPs work setting that prohibited use of mobile technologies in therapy (4.55%), and one response (2.27%) that fit into the "other" category, where the respondent reported that using apps in therapy cannot be justified as a skilled and billable service for Medicare reimbursement.

Attitude barriers referred to negative attitudes or opinions held by individuals who are affected by the implementation of the app (i.e. SLPs, clients, caregivers). Attitude barriers may include preference for other therapy materials (40.91%) or that the clients and/or their caregivers did not support the use of apps in therapy (11.36%).

Knowledge barriers referred to limitations in knowledge of app-based interventions on behalf of the SLP. This type of barrier included responses relating to having limited knowledge or awareness of apps, or limited knowledge about how to use mobile devices (11.36%). A respondent who presented skill barriers to using apps in therapy was aware that app-based interventions are available but lacks the skill or confidence to use them (11.36%). Access barriers referred to internal barriers within the client (e.g. motor, visual, or auditory limitations) that prevented the functional application and use of apps in speech-language therapy (9.09%).

Factors Influencing Adoption of Apps

The investigators noted popular trends in factors considered by SLPs when they buy apps. The most highly reported purchasing factors from the participants who employ use of apps in therapy included the goal targeted, recommendations from colleagues, price of the app, and the client's demographic features, such as client's age and gender. Surprisingly, respondents were least likely to consider research, ASHA recommendations, and search results. This result could also be attributed to the paucity of efficacy studies regarding apps in the field of speech-language pathology. In addition, the few studies that have been conducted are limited by inadequate research designs (Newmann, 2017; Schoen-Simmons, Paul, & Shic, 2016; Stone-MacDonald, 2014). It is important that SLPs remember to incorporate evidence-based practice (ASHA, 2017), because clinicians could potentially be using apps that have very little efficacy data and hinder the quality of therapy they provide.

Limitations

The results of this investigation have limitations in their methods, survey design, and participation, which hinder the generalizability of the study data.

Methods of Recruitment

Recruitment for the study was solely based on internet sharing, such as email and postings to forums; therefore, one way or another, all participants had to access the internet to take the survey. Since participants self-selected to participate and recruitment occurred online, the responses to the survey may be biased toward people who are internet or technologically-savvy, and therefore, more likely to use apps or incorporate mobile technology into their daily lives. Furthermore, even though the recruitment materials were phrased in a way which stated that participation from people who do not use apps was desired, the terms "apps" and "technology" were in the content of the message and this may have curtailed participation of non-app users.

In similar studies in the future, the investigators should take more conscious efforts to diversify the recruitment methods to yield a more accurate and representative sample of app-using and non-app using SLPs. For example, paper-based surveys could be sent in the mail. Future surveys may consider incentivizing participation. These incentives may include available discount codes or gift cards to websites where SLPs can buy materials.

Survey Design

Recruitment for the survey began on the first day which the survey was available to participants. It is possible that more responses may have been yielded if the survey had been open for longer than a one-week period. In the future, more conclusions about the demographic features of the participating SLPs could be made if more direct questions were asked about personal smartphone use, such as, "Do you own a smartphone?" or "Do you own a tablet?" or "Do you have internet access at home?" More questions may also have been asked about

purchasing factors and factors regarding access to evidence-based literature, such as "Do you have membership to any research databases or journals? If so, which ones?" Additionally, the survey was designed and developed in English, preventing the participation of SLPs who practice in America but could not read or respond in English. Lastly, in retrospect, it would be helpful to know how the participant was referred to the survey, so that in future studies, survey recruitment in the area of speech-language pathology can be effective.

Participation

The demographic features of app-users and non-app users did not differ significantly, but surprisingly, pediatric SLPs responded to the survey more frequently than SLPs who primarily work with adults, and app-using SLPs responded to the survey more frequently than non-app using SLPs. This occurrence makes it unclear if SLPs working with adults were less interested in responding because they use apps less frequently, or if other factors played a role.

Another recruitment aspect to consider is survey fatigue. On Facebook, and on the ASHA SIG discussion boards, a variety of surveys had already been posted by other researchers. With a variety of surveys being posted frequently on SIG discussion boards and Facebook groups, SLPs who may have been interested in participating in this study may have missed it or may have overlooked participation in this survey for a different survey of higher interest or priority to the potential participating SLP.

In summary, the recruitment methods used and the actual survey were internet-based, biasing the sample toward internet-savvy SLPs. Additionally, the uneven distribution between SLPs working with pediatric populations versus SLPs working with adult populations creates a barrier to generalizing the attitudes, opinions, and current practice patterns to SLPs who work

with adult populations. Therefore, it is advised that the results of the study should be generalized with caution.

Clinical Implications and Directions for Future Research

More SLPs who used apps for therapy-related reasons responded to the survey than SLPs who did not use apps. The high rates reported of using apps to target therapy goals raises some concerns about the efficacy of this treatment method. There are studies which have established the potential for app-based interventions, but they have been shown to have inadequate research designs and have a variety of limitations which make their findings resistant to being generalized to other client populations (Newmann, 2017; Papadakis, Kalogiannakis, & Zaranis, 2017b; Schoen-Simmons, Paul, & Shic, 2016; Stone-MacDonald, 2014). Given the limited number of high-quality efficacy studies regarding apps, there is not enough support to consider their use an evidence-based practice.

Munoz, Hoffman and Brimo (2013), the ASHA Code of Ethics (2016), and the ASHA statement regarding evidence-based practice (EBP) (2017) have solidified the urgent need for SLPs to support the app-based interventions they select with adequate EBP resources. The ASHA Code of Ethics (2016) states, "Individuals who hold the Certificate of Clinical Competence shall use independent and evidence-based clinical judgment, keeping paramount the best interests of those being served" (ASHA, 2016, pp.5). The ASHA code of ethics also states, "Individuals who hold the Certificate of Clinical Competence shall evaluate the effectiveness of services provided, technology employed, and products dispensed, and they shall provide services or dispense products only when benefit can be reasonably expected" (ASHA, 2016, pp.5). Efficacy studies related to app-based interventions are in their infancy, and it is not yet clear if

benefit can be reasonably expected from their implementation in speech-language therapy sessions.

It is important for practicing SLPs to recognize the critical presence of EBP in the standard practices of SLPs and the ASHA Code of Ethics. The results of the survey demonstrated that within the group of participating SLPs, they were more likely to ask a colleague or consider the price of the app over research studies or ASHA recommendations when purchasing an app. This may be the trend considering that the few published studies about the efficacy of apps are of limited quality (Newmann, 2017; Papadakis, Kalogiannakis, & Zaranis, 2017b; Schoen-Simmons, Paul, & Shic, 2016; Erickson, 2015; Stone-MacDonald, 2014). SLPs may consider seeking out evidence related to app-based interventions by evaluating all types of evidence and considering their "validity, reliability, precision, relevance, and importance." These values defined by ASHA's position statement of EBP can be applied to different types of evidence. Although it is not always possible to have access to a systematic review of a given therapy tool, clinicians can still employ standards of EBP to the best of their ability by performing their own independent judgement; that is, if a clinician has collected data supporting the efficacy of an app-based intervention that supports the client reach their goal, the clinician can justify the use of the app-based intervention with that client only (ASHA, 2017). The ultimate goals of EBP are to "promote the adoption of effective protocols, delay the adoption of unproven protocols, and prevent the adoption of ineffective interventions" (ASHA, 2017).

ASHA advises SLPs to take certain steps to integrate EBP into practice. Munoz, Hoffman, and Brimo (2013) have established clinical questions and frameworks that have been designed to assist SLPs decide whether they may integrate an app-based intervention into therapy, especially when efficacy studies supporting a given app are limited. Munoz, Hoffman,

and Brimo (2013) created a clinical framework based on ASHA (2017) EBP standards to guide clinical, evidence-based decisions that involve app-based interventions.

Munoz, Hoffman, and Brimo (2013) advised that the clinician should consider the client's needs, values, and the client's and/or caregivers' desired outcomes for therapy, by asking answerable clinical questions about the patient when determining if an app-based intervention is the best choice for this client, such as, "how much screen time does this client receive on average, within academic settings and at home?" or "does an efficacy study exist for the app-based intervention that I would like to use with this client?" In this step, the SLP should find and assess available current evidence to answer these questions, such as consulting the screen time recommendations from the American Academy of Pediatrics (American Academy of Pediatrics, 2016a; American Academy of Pediatrics, 2016b, Reid-Chassiakos et al., 2016; Kabali et al., 2015). The SLP may inquire about a variety of "media predictors," such as weekday screen viewing, weekday videogames or app use, availability of screens in bedroom and use of screens before bedtime (Sharif et al., 2010). In adult populations, smartphone addiction can be assessed using a tool such as the *Smartphone Addiction Scale* which measures addictive behaviors related to smartphone use (Duke & Montag, 2017).

After completing formal and informal assessment measures, the clinician should analyze the data to define goals, objectives, and expected outcomes, and select an appropriate treatment approach. Depending on the client's needs, the SLP must consult evidence and use reasonable clinician judgement to decide how to proceed (Munoz, Hoffman, & Brimo, 2013). Whether the clinician selects an app-based intervention or not, the interventions selected must support therapy goals (Munoz, Hoffman, & Brimo, 2013). For example, if a client's goals were to increase expressive vocabulary in spontaneous speech, the clinician may use a research database or

ASHA to search for evidence-based apps with strong empirical research to back their use. Evidence should feature the implementation of the app or mobile technology with individuals with language disorders (Munoz, Hoffman & Brimo, 2013).

The foundation of EBP is integration of research with clinician expertise and the client's and caregiver's wishes, too. ASHA (2017) and Munoz, Hoffman, and Brimo (2013) also advise that the SLP must consider the lifestyle, priorities, and perspective of a particular client to make a client-clinician team decision to proceed with the use of a given intervention. ASHA (2017) has recommended the SLP to collaborate with the client and compare the pros and cons of intervention to other interventions. An SLP and their client would have to make this determination together. Following this discussion, the SLP would affirm the next steps of the intervention process with the client, which may or may not include the use of the app-based intervention. The SLP must continue to evaluate the effectiveness of the app-based intervention relative to the client's therapy goals.

There are some evidence-based rubrics available to evaluate the content and quality of apps. Papadakis, Kalogiannakis and Zaranis (2017a) created the "Rubric for the Evaluation of Educational Apps for Preschool Children" to evaluate the educational, content, design, functionality, and technical qualities of preschool apps. Cherner, Lee, Fegley, & Santaniello (2016) also created a rubric to assess the quality of apps for teacher resources. Because it is not possible to create a single rubric to evaluate all apps, more research into frameworks for evaluating apps, and creating frameworks and guidelines for evaluating app-based interventions, treatment domains, and treatment populations is needed. SLPs must exercise caution and continual reevaluation of the efficacy of app use within their practice.

Munoz, Hoffman, & Brimo (2013) and ASHA (2017) emphasize that the clinician should explore the therapy-focused app, but should not rely on it as the only therapy technique used for the client. The clinician should explore other treatment techniques and compare the client's progress across therapy techniques to determine which treatment type works best for the client. After measuring treatment outcomes within both contexts, the clinician should determine which treatment technique best supports goal attainment (Munoz, Hoffman & Brimo, 2013).

ASHA (2017) also recommended keeping current with new evidence related to the app-based intervention's efficacy and use in speech-language therapy. To increase awareness of existing and emerging evidence-based resources, ASHA (2017) recommended that SLPs can become a member of multiple ASHA SIGS, become a member of other scholarly-based communities, such as researchgate.net, hosting and attending local and national conferences, participating in continuing education courses, reading ASHA publications and other scholarly articles and peer-reviewed literature, facilitating and supporting new research, and pursuing education for clinical and research based degrees (ASHA, 2017).

Not all applications have efficacy data or research on them which can be an obstacle, especially when integrating best practice standards into rehabilitation therapy. This model is used to ensure that clients meet their full potential when enrolled in speech-therapy or other therapy services (ASHA, 2016; ASHA, 2017). Clinicians who integrate EBP into their therapy may have difficulty rationalizing using an app as an alternative to a therapy solution because some apps have little research to back their efficacy, or research which is somewhat biased and paid for by the app developers. There is an urgent need for more research regarding how commonly SLPs and other rehabilitation professionals are using apps for therapeutic purposes, and additionally, the efficacy of said apps.

With the unprecedented rate at which apps are being published on common marketplaces, SLPs must also consider that these apps are available to download by any smartphone or tablet owner. In the context of alternative and augmentative communication (AAC), McNaughton and Light (2013) highlighted that AAC technologies available via mobile technologies have caused a "paradigm shift in service delivery," resulting in clients and patients downloading AAC apps without consultation from an SLP, bypassing assessment and intervention with an SLP altogether (McNaughton & Light, 2013, pp. 110). McNaughton and Light (2013) reported that only 54% of iPod or iPad AAC users received an AAC evaluation to determine which AAC system was most appropriate for the individual, and only 4% of families reported that professional support guided their AAC app purchase. Alike AAC communication apps, therapy-focused apps with very limited efficacy studies are available for purchase. There is potential for a similar trend to occur related to parents of children with unaddressed or unassessed speech and language needs, who believe that an app can address their speech and language needs. The danger is that there are very few app-efficacy studies which have a rigorous research design enough to claim app efficacy.

With the rapid emergence of apps and technologies, and the lack of efficacy studies to affirm if app-based interventions foster comparable therapy results to traditional therapies, SLPs must exercise caution when employing apps into practices. SLPs should consult the ASHA Code of Ethics (2016) and ASHA's Evidence-Based Practice statement when making clinical decisions that involve potential use of app-based interventions and when considering if such a clinical decision is the best intervention choice for the welfare of their client. Future directions of research should focus on producing individual randomized controlled trials and systematic reviews of randomized controlled trials of app-based interventions to affirm their efficacy when implemented with varying treatment populations and diverse sociodemographic groups (i.e. age,

income level, educational attainment, etc.), formalizing evidence-based rubrics and protocols to support clinical decisions related to integrating app-based interventions into speech-language therapy, and creating adequate assessments to measure and quantify screen time in treatment populations of all ages.

Conclusion

Apps are being commonly used to support a client's progress toward therapy goals but can also support clinicians with administration and management of a therapy session by providing timing functions, visual schedules, data-tracking abilities, and positive reinforcement. Although apps and mobile technologies intended for work-related purposes have been shown to increase autonomy, boost productivity, enhance of professional relationships, and provide efficient access to data in the workplace (Fenwick & Edwards, 2016), studies examining the efficacy of app-based interventions are in their infancy. Although apps have potential to be helpful in targeting speech-language therapy goals, existing efficacy studies are not empirically rigorous enough to affirm whether app-based interventions are efficacious (Zajc et al., 2018, Newmann, 2017; Papadakis, Kalogiannakis, & Zaranis, 2017b; Schoen-Simmons, Paul, & Shic, 2016; Erickson, 2015; Stone-MacDonald, 2014). Nonetheless, the current study presents data which affirm that many SLPs are using apps to target speech-language therapy goals, despite knowing little about their empirical integrity. Apps which are intended to target speech-language therapy goals, yet have no evidence-based veracity, are becoming available for purchase to the public at alarming rates. The rapid emergence of apps and mobile technologies is accompanied by the critical need for evidence affirming the efficacy of app-based interventions with diverse treatment populations, formalized evidence-based rubrics, and protocols to support clinical decisions related to app-based interventions, and empirically-based assessments to measure and

quantify screen time in pediatric populations, and questionnaires related to smartphone ownership and addition across all ages.

Research has established the popularity of ownership in all sociodemographic groups, including all ages, income levels, levels of educational attainment, races, and of varying disability identity (Pew Research Center, 2016; Morris, Jones, & Sweatman, 2016; Tsetsi & Rains, 2016) and access to mobile devices in both healthcare and educational settings (Harper & Milman, 2016; Fenwick & Edwards, 2016; Glackin, Rodenhiser, & Herzog, 2014). It is clear that both pediatric and adult populations have exposure to apps and mobile technologies.

SLPs must rely on the pillars of EBP to exercise clinically sound judgement when deciding if an app-based intervention is going to maximize a client's therapy outcomes. The SLP may consider the client's sociodemographic background (Tsetsi & Rains, 2016), assess total screen time exposure across the client's naturalistic environments (Sharif et al., 2010), compare total screen time to norms, especially with pediatric populations who are at an elevated risk for cognitive and health adversities related to use of smartphones and apps risks that accompany excessive use of smartphone technology, such as adverse physical and psychological outcomes in children, adolescents, and adults (Duke & Montag, 2017; American Academy of Pediatrics, 2016a, American Academy of Pediatrics, 2016b; Reid-Chassiakos et al., 2016). Overall, SLPs should only implement app-based interventions in the context of informed clinical judgement and evidence-based practices.

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APPENDICIES

APPENDIX A: Survey Exported from Qualtrics

Speech-Language Pathologists' Practices and Attitudes toward App Use in Therapy

Survey Flow

Block: Default Question Block (48 Questions)

Page Break

Start of Block: Default Question Block

Q41 Add consent form here.

Q1 Are you a speech-language pathologist?

- Yes (1)
- No (2)

Skip To: End of Survey If Q1 = 2

Q2 What is the highest degree you have attained?

- Master's (1)
- Ph.D (2)
- SLP-D (3)
- Other (4) _____

Q27 Do you have your CCC's or CFY?

- Yes, CFY-SLP (1)
- Yes, CCC-SLP (2)
- No, I do not. (3)

Skip To: End of Survey If Q27 = 3

Q5 Please select your gender:

- Male (1)
- Female (2)
- Other (3)

Q6 How old are you?

_____

Q7 How many years have you been practicing?

_____

Q41 In which state do you currently reside?

▼ Alabama (1) ... I do not reside in the United States (53)

Skip To: End of Survey If Q41 = 53

Q8 Please select the age of your **current primary treatment population.**

- ○ Pediatric (1)
- ○ Adults (2)

Q9 Please select your **current primary treatment setting.**

- Early intervention (1)
- Elementary school (2)
- Middle school/Junior high (3)
- High school (4)
- Acute (5)
- Subacute (6)
- Inpatient rehabilitation (7)
- Outpatient rehabilitation (8)
- Skilled nursing facility (9)
- Private practice (10)
- In-home care (therapist travels to the home of the patient) (11)
- Telepractice (therapist and patient use a secure face-to-face video chat) (12)
- Aural rehabilitation exclusively (Please describe facility) (13) _____
- University (14)
- Other (Please describe): (15) _____

Q14 I use a **smartphone** for personal use.

- Yes (1)
- No (2)

Q15 I use a **tablet** for personal use.

- Yes (1)
- No (2)

Q16 I have internet access at my primary treatment setting.

- Yes (1)
- No (2)

Q10 Does your primary work setting provide or lend you mobile technologies (i.e. tablet, smartphone, laptop) to use for work-related purposes, including therapy treatment, documentation, or as a supplementary learning tool?

- Yes, and I must share the device(s) with other professionals during my daily work (i.e. one iPad between two SLPs). (1)
- Yes, and I do not have to share the device(s) with other professionals during my daily work. (2)
- No (3)

Display This Question:

If Q10 = 3

Q12 If your primary work setting **does not l**end you a tablet or smartphone, do bring a personal mobile device to use (i.e. tablet, smartphone, laptop) for therapy treatment, documentation, or as a supplementary learning tool?

- Yes (1)
- No (2)

Q19 Which mobile technologies do you use in your primary treatment setting?

- [ ] Smartphone (1)
- [ ] Tablet (2)
- [ ] Laptop (3)
- [ ] Other (please describe): (4) _____

Q37 Which operating system do you prefer that your devices run on?

- ○ iOS (e.g. Apple iPad, iPhone) (1)
- ○ Android (e.g. Samsung Galaxy Tab, LG, Google Pixel) (2)
- ○ Windows (3)
- ○ Other (please describe): (4) _____

Display This Question:

If Q10 = 1

Or Q10 = 2

Q11 If your primary work setting lends you a tablet or smartphone, what purposes do you use it for?

- [ ] Documentation, data-tracking, note-taking (1)
- [ ] Therapy (2)
- [ ] Email (3)

Q13 Do you use apps for therapy-related purposes such as targeting therapy goals, compensatory aids, visual schedules, visual timer, and may also include data taking, or plan of care documentation (e.g. daily notes, progress notes, and other related documents) within an app? This does not include using apps as augmentative communication systems.

- YES, I use APPS for therapy-related purposes, (1)
- NO, I do not use apps for therapy-related purposes. (2)

Skip To: Q25 If Q13 = 2

Q20 I use with apps with _____% of my caseload.

- 10-25% (1)
- 25-50% (2)
- 50-75% (3)
- 75-100% (4)

Display This Question:
If Q13 = 1

Q17 You shared that you use apps in therapy. Apps can be used for a variety of purposes within a therapeutic setting. Please select all of the purposes for which you use apps.

- ☐ To target therapy goals (1)
- ☐ To provide compensatory aids or strategies (e.g., tracking behaviors, reminders, planners) (2)
- ☐ Behavioral Reinforcement (e.g., allowing a client to spend 2 minutes on an app as a reward) (3)
- ☐ Homework (e.g., assigning an individual to complete therapy tasks at home on an app) (12)
- ☐ Time management for the session (e.g., using a timer or clock app) (4)
- ☐ Visual schedule for the session (e.g., using a notes or drawing app to write out session schedule) (5)
- ☐ Collecting baseline data and measuring progress (e.g., using an app to make audiovisual recordings for tracking progress, Google Sheets) (6)
- ☐ Documentation, including progress notes, medical documentation, plans of care, IEP writing, etc. (9)
- ☐ Other (please describe): (8) _____
- ☐ Other (please describe): (7) _____

Display This Question:

If Q17 = 1

Q18 I use apps to target the following therapy or skill area(s) (check all that apply):

- ☐ Speech-sound production (1)
- ☐ Fluency (2)
- ☐ Expressive & Receptive language (3)
- ☐ Memory (4)
- ☐ Attention (5)
- ☐ Problem-Solving (6)
- ☐ Voice and/or resonance (7)
- ☐ Hearing (8)
- ☐ Swallowing (9)
- ☐ Other (please describe): (10) _____

Display This Question:

If Q18 = 1

Q26 What are your preferred apps to target speech-sound production?

_____

Display This Question:

If Q18 = 2

Q28 What are your preferred apps to target fluency?

_____

Display This Question:

If Q18 = 3

Q30 What are your preferred apps to target expressive & receptive language?

_____

Display This Question:

If Q18 = 4

Q31 What are your preferred apps to target memory?

_____

Display This Question:

If Q18 = 5

Q32 What are your preferred apps to target attention?

_____

Display This Question:

If Q18 = 6

Q29 What are your preferred apps to target problem-solving?

_____

Display This Question:

If Q18 = 7

Q33 What are your preferred apps to target voice and/or resonance?

_____

Display This Question:

If Q18 = 8

Q34 What are your preferred apps to target hearing or aural rehabilitation?

_____

Display This Question:

If Q18 = 9

Q35 What are your preferred apps to target dysphagia therapy?

_____

Display This Question:

If Q18 = 10

And I use apps to target the following therapy or skill area(s) (check all that apply): Other (please describe): Is Displayed

Q36 You selected "other" to describe the target skill(s) in which you use apps to target in therapy. Please describe 1) the targeted skill(s) and 2) the app which you use.

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 2

Q49 What are your preferred apps to be used for compensatory aids or strategies (e.g., tracking behaviors, reminders, planners)

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 3

Q50 What are your preferred apps to use for behavioral reinforcement?

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 4

Q51 What are your preferred apps to use for time management?

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 5

Q52 What are your preferred apps to use for visual schedules?

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 6

Q53 What are your preferred apps to use for collecting data and measuring progress?

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 9

Q54 What apps do you use for documentation?

_____

_____

_____

_____

_____

Display This Question:

If Q17 = 2

Or Q17 = 12

Q41 You shared that you assign use of an app as homework to reinforce the skill, and/or that you use apps as a compensatory aid for your client.

Both of these therapeutic uses of apps requires ownership or rental of a device to use outside of the therapy setting. Select the statement which best describes how you make this work.

- My primary treatment setting allows clients to rent/lend out mobile technologies (iPad tablet, iTouch, tablet, smartphone) for use outside of our treatment setting. (1)
- I personally rent/lend out mobile technologies that I personally own to my clients for use outside of our treatment setting. (2)
- This is typically not a problem since a large portion of my clients own mobile technologies (tablet, smartphone) at home. (3)

Q44
For use at home do you recommend apps that are free or that require payment?

- For use at home, I only recommend free applications to my clients. (1)
- For use at home, I recommend apps that require payment to my clients. (2)
- For use at home, I recommend both apps which are free and apps which require payment to my clients. (3)

Display This Question:

If Q44 = 2

Or Q44 = 3

Q45 You shared that you assign use of an app as homework to reinforce the skill, and/or that you use apps as a compensatory aid for your client. You have also shared that your clients use apps at home on a device which they own or a device which is rented to them. You have also shared that you recommend apps which require payment for homework or compensatory aid use.

Who pays for the app?

- ○ The client pays for the app themselves. (1)
- ○ My primary work setting pays for the app out of our budget or reimburses the client. (2)
- ○ As the therapist recommending the app, I pay for it out of pocket. (3)

Q21 My clients like using apps in therapy.

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Q23 When searching for apps to purchase, I consider the following factors (select all that apply):

- [ ] Demographic features of my client (age, gender) (1)
- [ ] My client's goals (2)
- [ ] Price of app (3)
- [ ] Research articles demonstrating the efficacy of the app (4)
- [ ] Reviews by users in the Apple App Store, Google Play Store, or an alternative app marketplace (5)
- [ ] Search results within the app marketplace (e.g. search for "memory game") (6)
- [ ] Reviews and recommendations from ASHA (American Speech-Language-Hearing Association) (7)
- [ ] Recommendations from colleagues (8)

Q22 The parents/caregivers of my clients like that we use apps in therapy.

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat disagree (4)
- ○ Strongly disagree (5)

Display This Question:

If Q13 = 1

Q46 Do you use apps in combination with other traditional therapy approaches?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Q46 = 1

Q47 You selected that you use apps in combination with other traditional therapy approaches. As a therapist, how do you justify using an app over using an alternative therapy approach? Briefly describe.

_____

Display This Question:

If Q13 = 2

Q25 If you do not use apps for therapy, why not? Please select all that apply.

- [ ] There are a limited number of devices with apps at work. (1)
- [ ] My primary work setting does not permit use of mobile technologies for therapy. (2)
- [ ] I am not allowed to download anything onto mobile devices at work. (3)
- [ ] If I want to use apps in therapy, I must use a personal device. I do not want my personal device to be damaged or stolen at work. (4)
- [ ] The budget at work for therapy materials is limited and mobile technologies are not a financial priority for us at this time. (5)
- [ ] It is not functional for my clients to use apps and mobile technologies. (6)
- [ ] I do not have internet access at work. (7)
- [ ] I prefer to use other therapy materials than apps and mobile technologies. (8)
- [ ] I have never considered it. (9)
- [ ] Apps and mobile technologies are distracting to my clients. (10)
- [ ] My clients do not like using mobile technologies OR the parents/caregivers of my clients would prefer that I do not use mobile technologies during therapy. (11)
- [ ] I did not know that therapy apps were out there and I would like to learn more about using them for therapy. (12)
- [ ] I know how to use mobile technologies, but I am not confident with them (e.g., I don't know how to purchase apps; I don't know how to use the accessibility features for my clients). (13)
- [ ] I do not use apps with my clients due to disabilities of the following nature(s): fine motor impairment, lack of mobility in the upper extremities, sensory-perceptual disabilities (visual, hearing, tactile, sensory) or learning & literacy disabilities. (14)
- [ ] Other (please describe) (15) _____

Q48 Thank you for participating in this survey. Please contact tbenedon@uwm.edu if you would like to learn about the outcomes of this survey or if you have any questions.

End of Block: Default Question Block

APPENDIX B: IRB Notice of Exempt Status

UNIVERSITY of WISCONSIN
UWMILWAUKEE
Department of University Safety & Assurances

Melody Harries
IRB Administrator
Institutional Review Board
Engelmann 270
P. O. Box 413
Milwaukee, WI 53201-0413
(414) 229-3182 *phone*
(414) 229-6729 *fax*

http://www.irb.uwm.edu
harries@uwm.edu

New Study - Notice of IRB Exempt Status

Date: July 3, 2018

To: Shelley Lund, PhD
Dept: Communication Sciences & Disorders

CC: Tessa Benedon

IRB#: 18.306
Title: Speech-language pathologists' opinions and attitudes toward app use in therapy

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has been granted Exempt Status under Category 2 as governed by 45 CFR 46.101(b). Your protocol has also been granted approval to waive documentation of informed consent as governed by 45 CFR 46.117 (c).

This protocol has been approved as exempt for three years and IRB approval will expire on July 2, 2021. If you plan to continue any research related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, please respond to the IRB's status request that will be sent by email approximately two weeks before the expiration date. If the study is closed or completed before the IRB expiration date, you may notify the IRB by sending an email to irbinfo@uwm.edu with the study number and the status, so we can keep our study records accurate.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation, and best wishes for a successful project.

APPENDIX C: Participant Consent to Participate

University of Wisconsin-Milwaukee
Informed Consent to Participate in Research

Study title: Speech-language pathologists' opinions and attitudes toward app use in therapy

Researcher[s]: Tessa Benedon, Primary Student Investigator, B.S., Department of Communication Sciences and Disorders, and
Shelley Lund, Associate Professor and Principal Investigator, Ph.D. CCC-SLP, Department of Communication Sciences & Disorders

We're inviting you to participate in a research study. Participation is completely voluntary. If you agree to participate, you can always change your mind and withdraw. There are no negative consequences, whatever you decide.

What is the purpose of this study?
We are interested in the attitudes and opinions of SLPs toward use of apps and other mobile technologies (e.g. tablets, smartphones) in the provision of speech-language therapy services. We hope to recruit SLPs who do AND do not use apps and mobile technologies in therapy.

What will I do?
This survey will ask questions about your current attitudes toward use of apps in therapy, including demographic factors related to the SLP, their primary treatment population and setting, whether they use apps, trends in app use, making decisions about purchasing apps, and barriers that prevent SLPs from using apps. The survey will take less than 15 minutes.

Risks
Some answers require a response; some do not. These questions are meant to explore demographic features related to the content of the study only. You can skip any questions you would not like to answer or stop the survey entirely.

- There is a slight risk of online data being hacked or intercepted. This is a risk you experience any time you provide information online. We're using a trusted and secure system to collect this data, but we can't completely eliminate this risk.
- There is a chance your data could be seen by someone who shouldn't have access to it. We're minimizing this risk in the following ways:
    - We'll store all electronic data on a password-protected, encrypted computer in which only the principal investigator and primary student investigator have access to.
    - The Qualtrics survey server will store your IP address with your data. It is necessary to record the IP address to ensure that only one response is submitted per IP address. Once we download the data from the server, we will remove all identifying information.

Possible benefits:
The anticipated benefits outweigh the risks of this survey. Benefits include a deeper insight into the current opinions, attitudes, and patterns of use of apps and mobile technologies in the provision of speech-language therapy services.

Estimated number of participants:
We hope to have between 250-500 people complete the survey.

How long will it take? It should take 15 minutes or less to complete the survey.

Costs: None

Compensation: None

Future research: De-identified data (all identifying information removed) may be used by Tessa Benedon or Dr. Lund in future studies. You won't be told specific details about these future research studies.

Confidentiality and Data Security
Your Internet Protocol (IP) address of your computer will be collected when you complete the survey. Data will be retained on the survey website server for up to 3 months and will be deleted after this time. However, data may exist on backups or server logs beyond the timeframe of this research project. Your data will be transferred from the survey site and will be save in an encrypted format for 10 years beyond the end of the study. The research team will remove your identifying information after downloading the data and all study results will be reported without identifying information so that no one viewing the results will ever be able to match you with your responses

Where will data be stored? Data from this study will be saved on a networked, password-protected computer in a locked room.

How long will it be kept? The data will be kept for 10 years beyond the end of the study.

Who can see my data?

- Only the researchers listed above will have access to your data. All identifying information will be removed so your identity will not be linked to your responses.
- The Institutional Review Board (IRB) at UWM, the Office for Human Research Protections (OHRP), or other federal agencies may review all the study data. This is to ensure we're following laws and ethical guidelines.
- We may share our findings in publications or presentations. If we do, the results will be presented as aggregate data with no individual results.

If you want to receive a summary of the results at the completion of the study, please contact Tessa Benedon at the email address below.

Contact information:
For questions about the research, complaints, or problems: Contact Tessa Benedon, tbenedon@uwm.edu or Dr. Shelley Lund, sklund@uwm.edu

For questions about your rights as a research participant, complaints, or problems: Contact the UWM IRB (Institutional Review Board; provides ethics oversight) at 414-229-3173 / irbinfo@uwm.edu.

Please print or save this screen if you want to be able to access the information later.
IRB #: XXXXXX
IRB Approval Date: July 3, 2018

Agreement to Participate
If you meet the eligibility criteria below and would like to participate in this study, click the button below to begin the survey. Remember, your participation is completely voluntary, and you're free to withdraw at any time.

- I am at least 18 years-old.
- I am currently practicing speech-language pathology in the United States of America.
- I have at least a Master's degree and hold a clinical certificate of competence in speech-language pathology (CCC-SLP **or** CFY-SLP).
- I am proficient in English or I will take the survey with use of either interpretation services or internet translation services.