

DISSERTATION

VOCATIONAL REHABILITATION ASSISTIVE TECHNOLOGY, ACCESS, SUPPORTED  
EMPLOYMENT, AND EMPLOYMENT OUTCOMES FOR TRANSITION-AGED YOUNG  
ADULTS WITH COGNITIVE DISABILITIES

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## ABSTRACT

### VOCATIONAL REHABILITATION ASSISTIVE TECHNOLOGY, ACCESS, SUPPORTED EMPLOYMENT, AND EMPLOYMENT OUTCOMES FOR TRANSITION-AGED YOUNG ADULTS WITH COGNITIVE DISABILITIES

**Objective:** The purpose of this dissertation was to conduct three research studies aimed at understanding the barriers and facilitators to equitable access to vocational rehabilitation (VR) assistive technology (AT), its utilization in supported employment (SE), and the resulting competitive integrated employment (CIE) outcomes of transition-aged young adults (TAYA) with cognitive disabilities.

**Introduction:** TAYA with disabilities face significantly higher rates of unemployment and underemployment than their peers without disabilities. For TAYA with cognitive disabilities, these disparities are even more pronounced, making them one of the most excluded groups from the labor force. Despite cognitive disabilities being the largest disability group served by state VR programs, this population continues to face poor employment outcomes upon exiting these programs. Although there is growing evidence of AT's potential to improve employment outcomes, AT support remains underutilized for TAYA with cognitive disabilities, with notable disparities in its utilization.

**Methods:** Study One employed a retrospective cross-sectional study using Rehabilitation Services Administration Case Service Report (RSA-911) data from 2017 to 2019, a period before the COVID-19 pandemic impacted state VR service operations. Multivariable logistic regression analysis was conducted to examine the main and interaction effects of various sociodemographic variables commonly considered in disparities research on the likelihood of receiving AT services

among TAYA with disabilities participating in state VR programs. This study provides a baseline understanding of disparities and access to AT services among TAYA with disabilities served by state VR programs in a pre-pandemic context. Study Two was a qualitative study. We conducted focus groups to gather insights from four key stakeholder groups—VR policymakers and funders, VR service providers, employers, and TAYA with cognitive disabilities and their families. The focus was on exploring their perspectives and experiences related to the transition to virtual support and how TAYA with cognitive disabilities accessed and utilized AT devices and services for facilitating their CIE during and following the COVID-19 pandemic. All focus group sessions were held virtually and video recorded and analyzed using thematic analysis. Study Three was another retrospective cross-sectional study using RSA-911 data from July 2017 to June 2022. We investigated how the receipt of AT and/or SE services was independently associated with obtaining CIE at program exit, and how the probabilities of achieving CIE varied across the pre-COVID, during COVID, and post-COVID periods among TAYA with cognitive disabilities served by state VR programs. Multivariable logistic regression analysis was used to calculate odds ratios for the likelihood of obtaining CIE at program exit among TAYA with cognitive disabilities who received the two VR services (AT, SE). To assess whether the relationships between these two VR services and CIE outcomes varied over time, interaction terms between the COVID-19 pandemic periods variable (pre-, during, and post-pandemic) and the two VR services of interest were included in the model.

Results: Study One revealed that less than 3% of TAYA with disabilities received AT services. The following client characteristics were associated with a lower likelihood of receiving AT services for TAYA with disabilities: unemployed, minority, significant disability, older in age, TAYA with mental and cognitive disabilities, and not enrolled in PSE. Study Two identified key

findings from focus group sessions, highlighting positive overall experiences with using mainstream mobile devices and applications. Areas for improvement beyond the pandemic include enhancing AT access through state Medicaid waivers, providing VR providers with training opportunities to deliver effective AT support to TAYA with cognitive disabilities seeking CIE who need and could benefit from such support, and ensuring the technology employed and used is accessible and usable by this population. In Study Three, more than half (55.9%) of TAYA with cognitive disabilities in the study sample did not achieve CIE at program exit. Only 1.4% received AT services and 10.7% received SE services. Overall, the receipt of AT and SE showed positive and significant associations with achieving CIE at program exit compared to those who did not receive these services. In addition, there were higher probabilities of achieving CIE outcomes during and post-COVID compared to the pre-COVID period.

Conclusion: The findings from this dissertation highlight the underutilization of AT support among TAYA with disabilities served by state VR programs, particularly in addressing their job-seeking needs and transitions from education to CIE. The shift to virtual support, accelerated by the COVID-19 pandemic, increased access to mainstream mobile devices and applications for TAYA job seekers with cognitive disabilities. Before the COVID-19 pandemic, AT support access was primarily focused on supporting TAYA with cognitive disabilities who were participating in academic programs or being employed for job retention, with limited AT support for job seekers. During the pandemic, however, TAYA job seekers with cognitive disabilities had access to mainstream mobile devices and applications within the VR system. Such access allowed this population to acquire skills in using mobile devices and applications for pursuing their CIE opportunities, access job training resources, continue receiving virtual supports, and engage in virtual job interviews with potential employers. The intersection of AT and SE offers

an opportunity to enhance CIE outcomes for TAYA with cognitive disabilities. The probability of achieving CIE was higher among this population receiving SE and AT support during and post-COVID than pre-COVID. This underscores the need for continued efforts to improve targeted transition policies and practices, enhance the services and supports for TAYA with cognitive disabilities, and provide AT training opportunities to VR personnel who serve this population. Increasing AT training in rehabilitation educational programs and in-service training could enhance VR AT service utilization. Further research is needed to generate evidence supporting AT use in vocational settings and to develop guidelines for its incorporation into employment transition processes. Such efforts are essential to ensuring that TAYA with cognitive disabilities have equitable opportunities and the support they need for employment success.

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## **CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW**

This section provides background information for the three research studies included in this dissertation. The focus was on understanding the barriers and facilitators to equitable access to vocational rehabilitation (VR) assistive technology (AT), its utilization in supported employment (SE), and the resulting competitive integrated employment (CIE) outcomes of transition-aged young adults (TAYA) with cognitive disabilities. AT and SE are key VR services that may enhance CIE outcomes for TAYA with cognitive disabilities.

### **Employment Outcomes and Transition-Aged Young Adults with Cognitive Disabilities**

Employment provides a sense of competence, purpose, belonging, and opportunities for social engagement (Roux et al., 2019; Chen et al., 2014). From an early age, children are asked, "What do you want to be when you grow up?" A question that resonates with dreams, hopes, and a bright future. Yet, for many young adults with disabilities, these youthful dreams often fade into the harsh reality of adulthood. Their aspirations, no less vivid or worthy, are frequently stifled by a world that overlooks their capabilities. Despite a desire to contribute, to be part of a community, and to live a life of purpose, young adults with disabilities are often unemployed or underemployed, even though they desire and have the capacity to work in the community (Winsor et al., 2021).

According to the Bureau of Labor Statistics (2024), young adults with disabilities experience considerably higher unemployment rates compared to individuals without disabilities: 26.7% vs. 17.7% for 16-19 year olds and 21.1% vs. 13.5% for 20-24 year olds. In addition to being underrepresented in the workforce, they face underemployment, less job security, lower wages, and are more likely to work part-time with fewer employer-provided benefits than their peers without disabilities (Luhr et al., 2023; Winsor et al., 2021).

For TAYA with cognitive disabilities, these disparities in unemployment and underemployment are far greater. They face lower employment rates than those with other types of disabilities (Chen et al., 2015; Kaya et al., 2021; Weld-Blundell et al., 2021; Newman et al., 2011), making them one of the most excluded groups from the labor force (Nord, 2020). According to the most recent Annual Disability Statistics Compendium (2023), 66.4% of those with cognitive disabilities are unemployed. The American Community Survey (ACS) reports that 40% of TAYA with auditory disabilities and 36% of TAYA with visual disabilities are employed, while those TAYA with cognitive disabilities have the lowest employment rate at 30.0% (Erickson, Lee, & von Schrader, 2022). Cognitive disability accounts for the highest rates of reported disability (69.5%) among the TAYA population (Cheng & Shaewitz, 2019). Despite forming the largest segment of state vocational rehabilitation (VR) service users, TAYA with cognitive disabilities often experience poor employment outcomes upon exiting state VR programs (Burgess & Cimera, 2014; Chen et al., 2015; Cimera & Cowan, 2009; Kaya, 2018; Lawer et al., 2009; Migliore et al., 2014; Winsor et al., 2021). When TAYA with disabilities do not successfully transition out of high school, they may face a lifetime of continued reliance on public assistance, potentially resulting in significant costs to society (U.S. Government Accountability Office, 2012).

### **Policies Guiding State Vocational Rehabilitation Programs**

The foundation for today's state VR programs was laid with the Smith-Fess Act of 1920, also known as the Vocational Rehabilitation Act (repealed 1973), which provided federal funds to states for the purpose of providing VR services, marking the beginning of the state VR program, but only for those with physical disabilities (Pub. L. No. 66-236, 41 Stat. 735). Subsequent laws expanded VR services to include all individuals with disabilities. For example,

the Vocational Rehabilitation Act Amendments of 1954 expanded VR services to serve individuals with other types of disabilities and emphasized training for VR personnel to effectively serve all individuals with disabilities (Pub. L. No. 83-565, 68 Stat. 652). The state VR programs were later operationalized by the Rehabilitation Act of 1973, which provided statutory authorization for state VR programs, highlighting the importance of promoting independence, community integration, and equal access to employment opportunities. This legislation builds on the social model of disability, asserting that disability is a natural part of the human experience and has no bearing on an individual's right to pursue jobs or to be fully included in society (Pub. L. No. 93-112, 87 Stat. 355). Building on the foundation of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973 was the first federal civil rights protection prohibiting discrimination based on disability in any program or activity receiving federal funding, requiring equitable access to work and educational opportunities. This laid the groundwork for future legislation such as the Americans with Disabilities Act (ADA) of 1990 (Pub. L. No. 101-336, 104 Stat. 327), which extended that protection to all entities, regardless of receipt of federal funding. The ADA ensures that people with disabilities have equal opportunities to benefit from all programs, services, and activities. Title II of the ADA also enhanced accessibility. This includes, but is not limited to, providing information and documents in accessible formats or digital formats compatible with assistive devices, and newly extending accessibility to web and mobile applications (U.S. Department of Justice, 2023).

The Rehabilitation Act Amendments of 1984 supported the goals of the Rehabilitation Act of 1973 by helping individuals with disabilities secure and maintain employment in integrated settings (Pub. L. No. 98-221, 98 Stat. 17). The concept of supported employment (SE) gained formal recognition with these amendments, aiming to help the transition-aged population

with disabilities obtain and maintain integrated employment (U.S. Department of Labor, 1984). The 1992 amendments required state VR programs to improve transition planning and services for transition-aged population with disabilities, ensuring a smoother transition from school to employment or further education. These amendments also mandated the development of an Individualized Plan for Employment (IPE) for each person receiving state VR services, tailored to their unique strengths, resources, priorities, concerns, abilities, and capabilities (Pub. L. No. 102-569, 106 Stat. 4344). The Rehabilitation Act Amendments of 1992 also established the Cultural Diversity Initiative to address the higher rates of disabilities among minority individuals and to enhance the quality and delivery of VR services to minority populations.

Additionally, the Rehabilitation Act was amended in 1986 (Pub. L. No. 99-506), 1992 (Pub. L. No. 102-569), and 1993 (Pub. L. No. 103-73), with both amendments emphasizing the benefits of Assistive Technology (AT) as a valuable tool to improve the lives of individuals with disabilities. The Technology-Related Assistance for Individuals with Disabilities Act of 1988, also known as the Tech Act, was the original legislation aimed at increasing access to AT for individuals with disabilities (Pub. L. No. 100-407, 102 Stat. 1044). The Assistive Technology Act of 1998, designated as Public Law 105-394, replaced, reauthorized, and built upon the 1988 Tech Act and its 1994 amendments (Pub. L. No. 103-218, 108 Stat. 50). Subsequent amendments in 2004 continued to emphasize the importance of AT, supporting access, availability, and funding for AT services and devices, and enhanced training capacity to provide AT services and devices. These amendments emphasized the importance of providing AT services to individuals of all ages and aimed to standardize the provision and access to AT services across states, ensuring that individuals could access AT and receive training to use them effectively (Pub. L. No. 108-364, 118 Stat. 1709).

The Individuals with Disabilities Education Act (IDEA), originally enacted in 1975 and amended in 2004, focused on preparing students with disabilities for post-secondary life. It required schools to include transition planning in the Individualized Education Plan (IEP) starting at age 16 until the student reaches age 22 or completes their secondary education. Schools were also directed to consider AT support when formulating IEPs. It required state VR programs to collaborate with secondary schools to facilitate better transitions. The IDEA addressed the skills and services needed to support students' transitions to adulthood, including employment, independent living, and further education (Pub. L. No. 108-446, 118 Stat. 2647).

Most recently, the Workforce Innovation and Opportunity Act (WIOA) of 2014 reauthorized the Rehabilitation Act of 1973 with the aim of improving employment outcomes for individuals with disabilities, particularly in competitive integrated employment (CIE). WIOA strengthened state VR programs' role in the transition process, increasing access to training, support, and services for TAYA with disabilities beginning at age 14 until the individual reaches the age of 25 (Pub. L. No. 113-128, 128 Stat. 1425). WIOA requires state VR programs to collaborate with schools and workforce development systems to facilitate the transition of students with disabilities from school to CIE settings, ensuring jobs that pay at least minimum wage, offer opportunities for advancement, and are in integrated work environments (Winsor et al., 2021).

Overall, these legislative acts reflect an historical movement from segregation toward more community integration and inclusion for individuals with disabilities. The Rehabilitation Services Administration (RSA) within the U.S. Department of Education (DOE) is the federal agency responsible for administering and overseeing state VR programs. RSA monitors and evaluates the performance of state VR programs to ensure they meet federal standards and

achieve desired outcomes for individuals with disabilities. Today, many TAYA with disabilities who are unemployed, underemployed, or at risk of losing their jobs rely on state VR programs for public assistance. These programs are uniquely positioned to help TAYA with disabilities bridge gaps in their transition to adulthood and access the individualized VR services needed to prepare for, secure, retain, regain, or advance in CIE (RSA, 2019).

### **Vocational Rehabilitation Assistive Technology Services**

VR services are designed to empower individuals to maximize employability, self-sufficiency, independence, integration into the community, and achieve CIE. AT services are one of the VR services that are provided through state VR programs or offered by comparable benefits providers for VR clients with disabilities, assisting them in the selection, acquisition, and/or training on the use of devices. The standard definition of an AT device is *“any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities”* (Pub. L. No. 108–364, 118 Stat, 1710). This broad definition covers any piece of technology that can assist an individual with a disability, including mainstream mobile devices and applications. AT services are defined as *“any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device”* (Pub. L. No. 108–364, 118 Stat, 1710). This assistance can include the evaluation of the needs, selecting a device, and training on the use of the device (RSA, 2019).

Previous research supported the use of mainstream mobile devices and applications for TAYA with cognitive disabilities to improve work task completion, promote independence in the workplace, enhance employment-related outcomes, and provide access to more employment opportunities (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013; Collins & Collet-

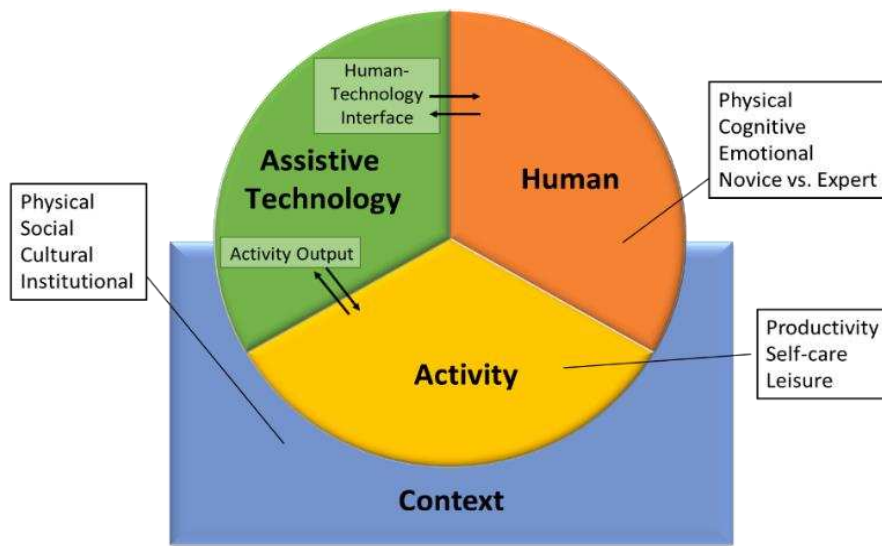
Klingenberg, 2018; Damianidou et al., 2019; Kuo et al., 2023; Lenker et al., 2013; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010). Despite evidence showing the benefits of AT services on employment outcomes (Ahonle et al., 2020; Chiu et al., 2015; Duncan et al., 2020; Huang et al., 2013; Kaya et al., 2016; Sprong et al., 2019), these services are underutilized in state VR programs, particularly among younger adults and those with cognitive disabilities (Alshamrani et al., 2023; Chen et al., 2015; Huang et al., 2016; Sprong et al., 2019).

### **Human Activity Assistive Technology (HAAT)**

The Human Activity Assistive Technology (HAAT) model, introduced by Drs. Cook and Hussey in 1995, guides the AT support process (Figure 1). The model provides a framework for understanding the interaction between four components: the human, activity, AT, and context in which these interactions occur. Prior AT frameworks have been criticized for being technology-centric, requiring individuals with disabilities to adapt to the technology rather than the technology meeting the needs of the person (Wahidin et al., 2018). The HAAT model is a client-centered approach focused on the client (human) doing something (activity) in context and then introduces the AT (Cook et al., 2020). AT support should be tailored and evaluated by how well it is matched to the individual, not vice versa (Shay et al., 2018).

The HAAT model is an integration of the human, activity, and AT nested in the context. The human component includes an assessment of the person's abilities and limitations. Beyond functional capacity, an understanding of the person's life roles and experiences with technology, personal goals, and motivation are important aspects of the human component. Scherer et al. (2007) and Wessels et al. (2004) emphasized the importance of addressing both the functional and psychological aspects of the client to ensure better outcomes. The activity component assists in understanding the activity in which the individual wants or needs to perform. It involves

analyzing task demands and identifying how AT can enable the individual to successfully complete the chosen activity. When applying the HAAT model to service delivery, the activity or need is identified first followed by the aspects of the human that affect the ability to perform and engage in the activity. The contextual influences that affect performance are then considered. The AT prescription and recommendations come last (Cook et al., 2020).



**Figure 1.** Human Activity Assistive Technology (HAAT) Model.

*Note.* Diagram sourced from Cook & Hussey (1995).

AT service delivery requires collaboration and client-centered approaches, involving input and participation from the client, family members, and relevant professionals (Cook et al., 2020; Scherer et al., 2005; Wielandt et al., 2006). The client is central to the collaborative team (Smith et al., 2018). User involvement in the selection and decision-making process ensures the AT meets their needs and preferences, leading to successful adoption (Scherer & Federici, 2015). Many students with disabilities, often quite typical in K-12, may not be well-equipped to ask for or advocate for their needs as they transition into employment, particularly if they did not develop these skills during their K-12 education. This can lead to AT being prescribed without

input from the user, making it less likely to be used to its full potential (Scherer & Glueckauf, 2005). Access to training, once the device is received, ensures the client gains the full benefit of its use. AT users often rely on service providers for information and training (Cook et al., 2020). Significant factors contributing to the non-use of AT are the absence of user involvement in the selection and decision-making process (Martin et al., 2011) and a lack of training and information provided to the user (Howard et al., 2022). Individuals with disabilities can improve their work performance and participation outcomes if they are provided with the appropriate AT, trained in its proper use, and receive necessary work accommodations (Anand & Sevak, 2017; Brown-Triolo, 2002; Field & Jette, 2007; Shay, 2018).

## **Influence of System-Level Factors on Assistive Technology**

### **Policy Funding**

The primary funding sources for VR services, including AT devices and services, are state VR programs and state Medicaid programs under Home and Community-Based Services (HCBS) waivers (Friedman, 2022; Winsor et al., 2021). State Medicaid programs are the largest funding source for AT in the United States. However, Medicaid terminology for the concept of AT refers to items such as durable medical equipment (DME), prosthetic devices, and specialized AT for those who are blind, deaf, or physically impaired, reflecting an outdated medical model of disability (Cook et al., 2020). In this context, funding for AT devices and services is allocated based on medical model alone rather than considering social model of disability (Canning, 2005). The prevailing medical model, which predominantly guides the current state and public AT funding, tends to prioritize the individual's medical needs. This model often overlooks the roles of AT in enhancing employment outcomes, independence, and societal participation. It generally lacks alignment with practical AT concepts for implementing

effective solutions such as individual choice, empowerment, independence, performance, employment, and enhancing the quality of life. AT concepts are not necessarily related to medical necessity (Arthanat et al., 2017; Canning, 2005; Cook et al., 2020; Howard et al., 2022; Wallace, 2011), resulting in difficult choices for clients, families, and service providers. It became evident that the funding framework primarily accommodates medical needs for AT but falls short of supporting employment-related AT. Due to the AT funding policies being driven by the medical model, Arthanat et al. (2017) highlighted that service providers often find it easier to justify AT funding when the need is framed as a medical necessity. AT's role extends beyond medical necessity for improving job performance, employment outcomes, empowerment, participation, and independence. This discrepancy highlights a gap in current policy frameworks. In its report, *The Future of Disability in America*, the Institute of Medicine (IOM) committee recommends increased federal support for people with disabilities, including coverage for AT devices and services in Medicaid. They advocate for policy reforms in Medicaid to increase access to AT and remove obstacles that limit what too many individuals with disabilities can achieve (Field & Jette, 2007). These recommendations are as relevant today as they were in 1991 and 1997 (Ottenbacher et al., 2012). In recent research, Friedman (2023) found that less than 3% of individuals with cognitive disabilities receive AT devices and services through Medicaid HCBS waivers across the United States.

The other primary funding for AT devices and services is provided through state VR programs. During the process of developing an IPE, VR counselors assess clients' eligibility for participation in VR programs and determine the specific types of services that should be funded (RSA, 2019). For TAYA with disabilities still participating in the secondary education system, funding for AT devices and services is often facilitated through IDEA. State VR programs are

specifically referred to in the IDEA regulations. The IDEA regulations note that nothing in the transition services requirements relieves any participating agency, “including a state VR agency,” of the responsibility to provide or pay for any transition service, including AT devices and services (34 C.F.R. § 300.324(c)(2)). Often state VR programs collaborate with secondary schools and identify students' AT needs from IEPs at application. On the other hand, the Title I of ADA mandates AT accommodations for employees with disabilities as appropriate, while Title II mandates such accommodations for students, including those in PSE and higher education institutions, to provide necessary accommodations to students with disabilities. This includes the provision of appropriate AT to enable students with disabilities to have equal access to educational opportunities. Section 504 of the Rehabilitation Act of 1973 specifically pertains to any institution that receives federal funding and requires any federally funded institutions to offer reasonable accommodations, including AT. However, in developing IPEs for TAYA with disabilities who are unemployed, out of the education system, and actively seeking jobs, the employment-related needs for AT devices and services are often overlooked (Hager & National Disability Rights Network, 2013), particularly for those young job seekers with non-apparent disabilities (i.e., cognitive or mental health conditions).

### **Vocational Rehabilitation Personnel Training**

Chen et al. (2015), Huang et al. (2016), Sprong et al. (2019), Lee et al. (2020), and Alshamrani et al. (2023) consistently report low utilization rates of AT services within state VR programs. The literature recommends more training on AT for VR personnel (Arthanat et al., 2017; Barzegarian & Sax, 2011; Estrada-Hernandez et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006; Riemer-Reiss, 2003; Szymanski et al., 1993). Noll et al. (2006) noted that VR personnel are more likely to provide AT services when they have

greater knowledge in AT. Similarly, Riemer-Reiss (2003) found that training is positively associated with referrals to AT services in state VR programs. They further noted that many VR personnel employed by state VR programs have not had sufficient AT training during their rehabilitation educational programs or had received short-term training. In addition, curricular standards for rehabilitation educational programs, including rehabilitation counseling programs often have few and generic AT training requirements (Arthanat et al., 2017). The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) offers training and certification opportunities for VR personnel to become certified Assistive Technology Professional (ATP). While some VR personnel choose to further their training and become certified ATP's through RESNA, this is neither required nor encouraged by state VR programs (Kuo & Kosciulek, 2021). Conferences like Accessing Higher Ground, CSUN Assistive Technology Conference, and Assistive Technology Industry Association (ATIA) could provide more insights into using AT, showcasing innovative solutions that foster participation and accessibility in educational and vocational settings. They also address the integration of AT into employment support, which aligns well with VR personnel's goals in supporting individuals with disabilities. Recent studies have highlighted concerns regarding the training of VR personnel, emphasizing the need to address AT training to better support clients (Anderson et al., 2021; Dallas et al., 2022; Heman et al., 2022; Pogoda et al., 2021). There is a persistent need for more AT training for VR personnel, as inadequate training can result in the underutilization of AT services.

## **Influence of Person-Level Factors on Assistive Technology**

### **Severity of the Individual's Disability**

State VR programs serve over a million individuals with disabilities annually, with 91% having significant disabilities that impede employment (RSA, 2019). Significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment. An individual with a significant disability is an individual who has a severe disability that impacts their ability to obtain or maintain employment. Such individuals typically have complex needs and require more VR services than those with a non-significant disability. Although they represent a majority of individuals seeking VR services and need AT support the most, research shows they are less likely to access AT devices and services compared to their peers without significant disabilities, and they also have lower employment success upon program exit (Alshamrani et al., 2023; Nord & Hepperlen, 2016; Kaye et al., 2021). Sprong et al. (2019) found that receiving AT services improved employment success for VR clients with significant disabilities. Furthermore, workers with significant disabilities report that AT is essential for increasing their opportunities to work successfully in the community (National Council on Disability, 2020).

Individuals with significant disabilities experience more limitations and have more complex needs. Consequently, they tend to have poorer employment outcomes and require access to tailored support and services (Strauser, 2020). They are also more likely to require extended services and long-term support, often incurring costs that exceed what state VR programs cover (Lawer et al., 2009). Medicaid serves as the primary payer for extended services and long-term support for individuals with significant disabilities, through HCBS waivers. These waivers may limit the ability to purchase devices or access AT services. Friedman (2023)

examined how states offered AT devices and services for those with significant cognitive disabilities in their Medicaid HCBS waivers across the United States and found that less than 3% of this population received AT devices and services.

Additionally, there is a negative relationship between receiving disability cash benefits and obtaining employment among young adults with significant disabilities (Iwanaga et al., 2021). This can lead to underutilization of VR services due to a lack of motivation and fear of losing their benefits upon employment (Gonzales et al., 2011; Kaye et al., 2008). Low-income families might also encourage young adults to remain on public support systems to maintain a regular income and other benefits (Kaye et al., 2021; Luecking & Wittenburg, 2009). Access to AT services alone may not effectively facilitate employment for clients with significant disabilities unless they also have access to benefits counseling services. These services provide counseling to help clients, and their families understand that they can work without immediate changes to their benefits, enabling them to make informed decisions about employment options and the potential work earnings (Kaya et al., 2023; Leahy et al., 2014).

### **Minority Status**

There are documented racial disparities within state VR services (Atkins et al., 1980; Capella, 2002; Wilson, 2002; Bellini, 2003; Wilson & Senices, 2005; Smart & Smart, 1997; Sprong et al., 2015; Yin et al., 2022). Smart and Smart (1997) reported that African Americans and other minority groups experience disability at higher rates than Whites, and Wilson (2000) suggested that minority groups should be more adequately represented and served by state VR programs. Alshamrani et al. (2023) found that minority VR clients were less likely than White clients to receive AT services. Similarly, the utilization of other VR services, such as SE, varies by race and ethnicity (Houseworth et al., 2022). Sprong et al. (2015) noted that minority clients

are less likely to obtain high-quality VR services compared to White clients. Capella (2002) found that White clients with disabilities had a 50% higher likelihood of being accepted into VR services compared to African Americans. Bellini (2003) showed that the average cost of VR services was higher for White clients than for minority clients. Atkins et al. (1980) found that minority clients faced disadvantages at each step of the VR process—application, eligibility, service provision, and employment outcomes at closure—compared to White clients. Yin et al. (2022) found that minority clients had lower eligibility rates, service rates, and employment rates than White clients. Thus, discrimination based on race continues to exist within state VR programs despite several legislative acts and policy efforts (Sprong et al., 2015; Yin et al., 2022).

### **Education Level**

VR clients with higher educational attainment are more likely to access AT services compared to those with lower levels of education (Huang et al., 2016; Sprong et al., 2019). Yeager et al. (2006) examined how AT accessibility varied by educational attainment, revealing that more educated individuals with disabilities were more likely to access AT. Similarly, Kaye et al. (2008) reported that AT access increases with educational attainment and income. Additionally, higher educational attainment has been associated with higher digital literacy, income, and more access to resources (Chen et al., 2024; Khanlou et al., 2020). More educated individuals are more likely to be aware of the benefits of AT, conduct their own research on AT, request resources and information, know what they want the technology to do, and be more active in driving AT selection compared to individuals with lower educational attainment (Cook et al., 2019; Huang et al., 2016; Kaye et al., 2008; Rumrill et al., 2013). A critical aspect to consider, as highlighted by Boot et al. (2018) and others (Chen et al., 2015; Field & Jette, 2007; MacLachlan et al., 2018), is that lack of awareness can significantly limit the use of AT devices

and services. Post-secondary institutions often provide AT as part of their disability services, which plays a pivotal role in increasing awareness and familiarity with the use of AT among students with disabilities. This exposure is crucial as it not only facilitates academic success but also raises students' awareness about the benefits of using AT. It is also plausible that individuals with lower educational attainment may experience a gap in awareness and exposure to AT compared to those enrolled in PSE and higher education institutions. This disparity in exposure often results in reduced familiarity with and utilization of AT, which can perpetuate accessibility and employment challenges among this demographic. Furthermore, this lack of awareness may extend beyond individual educational attainment to include service providers, who might be unaware of the technologies that are available and/or the potential benefits of using them (Kaye et al., 2008).

### **Employment Status**

Employed clients are more likely to receive AT services than unemployed clients (Chiu et al., 2013; Tansey et al., 2015; Chiu et al., 2015; Huang et al., 2016; Sprong et al., 2019). Stumbo et al. (2009) highlighted that unemployed VR clients may not be familiar with AT options that could improve their employment prospects. This can result in missing out on possible employment that would be accessible to them with the use of AT (MacLachlan et al., 2018). Sprong et al. (2019) found that unemployed VR clients who accessed AT services at the time of application had a significantly higher chance of obtaining employment than unemployed VR clients who did not access AT services. Overall, employment at the time of application appears to be a factor determining access to AT services in state VR programs. Despite the potential benefits of improving employment prospects for job seekers or providing job seekers

with access to more employment opportunities, such services tend to focus more on supporting job retention needs rather than job-seeking needs of clients served by state VR programs.

## **The Impact of the COVID-19 Pandemic**

### **Impact on Employment**

The COVID-19 pandemic negatively impacted the employment status of individuals with disabilities (Okyere et al., 2021; Sinclair et al., 2020; Schall et al., 2021; Wong et al., 2022; Embregts et al., 2020; Rosencrans et al., 2021). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic (Cucinotta & Vanelli, 2020). The pandemic led to the highest unemployment rate in the United States since 1948, driven by mandatory shutdowns and voluntary business closures, which resulted in furloughed or laid-off employees (Wong et al., 2022). In April 2020, the unemployment rate surged, surpassing the peaks of the Great Recession, and labor force participation plummeted, particularly affecting many young adult workers and those with lower educational attainment, who experienced higher unemployment rates and significant declines in labor force participation (Falk et al., 2021). These individuals often worked in industries hit hardest by the pandemic, such as retail, entertainment, and food services (Schall et al., 2021). Health concerns and vulnerability to severe illness from COVID-19 also led many to leave the workforce (Rosencrans et al., 2021; Okyere et al., 2021). Early in the pandemic, only 46% of young adults with cognitive disabilities who received support for employment continued working, while 38% were furloughed or laid off, and 14% stopped working for personal reasons (Butterworth, 2021). While more remains to be learned about the long-term effects of the COVID-19 pandemic on employment for young adults with cognitive disabilities, the long-standing disparities in employment participation were increased during the pandemic (Mahoehey et al., 2024). Despite the challenges, many

individuals with disabilities wanted to continue looking for jobs or maintain their jobs during the pandemic (Sinclair et al., 2020). There has been limited research on the pandemic-related changes in employment support for TAYA with cognitive disabilities, and how this population was supported during and is being supported following the pandemic.

### **Impact on Employment Support Delivery**

The pandemic not only affected employment status but also disrupted the delivery of VR services (Hartley & Bourgeois, 2020; Mahoehney et al., 2024; Hartley et al., 2023; Pogoda et al., 2021; Anderson et al., 2021). Many clients experienced a shift from in-person to virtual support, had their services reduced, or lost all support during the pandemic (Hewitt et al., 2022). Less than 40% of VR service providers had provided virtual support before the pandemic; this figure rose to 98% during the pandemic (Hartley et al., 2023). Even as pandemic restrictions waned, virtual supports persisted, with many VR service providers reporting they will continue to use virtual supports post-pandemic (Butterworth, 2021; Hartley et al., 2023; Hinton et al., 2023; Mahoehney et al., 2024; Timmons et al., 2022). Virtual support holds promise for increasing service accessibility, inclusivity, and efficiency (Ahonle et al., 2021; Akemoglu et al., 2021; Hinton et al., 2023; Mahoehney et al., 2024; Ottomanelli et al., 2021; Tassé et al., 2020). However, there remains a knowledge gap regarding how service providers deliver this type of support to assist their clients in searching for, obtaining, and maintaining CIE.

### **Impact on Assistive Technology Access and Utilization**

Before the pandemic, several studies identified barriers to AT support (Estrada-Hernández et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006). During the pandemic, Pogoda et al. (2021) noted that these challenges were exacerbated by professionals' lack of familiarity with benefits of AT. This period underscored the importance

of increasing AT access (Froehlich et al., 2023; Hartley et al., 2023). The pandemic prompted a shift to greater use of mainstream mobile devices and applications, some state VR programs responded by implementing policies to improve access, including purchasing mainstream mobile devices and applications for clients (Anderson et al., 2021). Dallas et al. (2022) reported that many VR service providers faced challenges in supporting their clients, including inadequate funding for accessing mainstream mobile devices and applications. Friedman (2022) noted that recipients of HCBS waivers encountered barriers due to policy restrictions on funding for mainstream mobile devices and applications. VR clients who previously received in-person support needed mobile devices or applications to maintain and engage in employment-related activities during the pandemic. There remains a knowledge gap regarding how AT was accessed, selected, and utilized. Additionally, there is limited information on the new normal, following the pandemic, regarding the types of AT services, extent of their use, and how this is impacting employment success moving forward.

### **Assistive Technology Services Access for Transition-Aged Young Adults with Disabilities in State Vocational Rehabilitation Programs**

Previous research has consistently shown that TAYA with disabilities experience disproportionately high rates of unemployment and underemployment (Bureau of Labor Statistics, 2020; Carter et al., 2012; Hiersteiner et al., 2018; Cheng & Shaewitz, 2019; Grigal et al., 2014; Sanford et al., 2011; Shattuck et al., 2012). The benefits of AT in enhancing work participation, performance, task completion, independence, communication, and overall employment outcomes are well documented (Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Lenker et al., 2013; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010). Despite the evidence demonstrating the benefits of VR AT services in achieving positive

employment outcomes in state VR programs (Ahonle et al., 2020; Chiu et al., 2015; Duncan et al., 2020; Huang et al., 2013; Kaya et al., 2016; Sprong et al., 2019), these services remain underutilized, with notable disparities in their utilization. Having a better understanding of the reasons for underutilization and limited access will help policy and practice in reducing barriers and improving accessibility to AT support for TAYA with disabilities who could benefit from such support to optimize their employment outcomes.

### **Assistive Technology Utilization and Supported Employment for Transition-Aged Young Adults with Cognitive Disabilities During and Following the COVID-19 Pandemic**

SE is an individualized VR intervention that aligns with job seekers' strengths, priorities, abilities, interests, and informed choices to help them obtain and maintain CIE by assisting them in job discovery, job placement, identifying training needs for job skills, and job coaching (Schall et al., 2015). SE is traditionally provided in person (Wehman et al., 2018). However, the pandemic led to a shift to virtual support and increased the use of AT to assist job seekers in achieving and maintaining employment.

Virtual supports may be the new norm, circumventing many of the barriers associated with in-person service delivery and potentially increasing service accessibility, inclusivity, and efficiency (Ahonle et al., 2021; Akemoglu et al., 2021; Hinton et al., 2023; Mahoehney et al., 2024; Ottomanelli et al., 2021; Tassé et al., 2020). It provides more inclusive support that aligns with individuals' preferences and circumstances (Healy et al., 2023); addresses the shortage of VR service providers in underserved areas (Ahonle et al., 2021); increases engagement and timeliness of VR services by decreasing transportation barriers and associated costs (Embree et al., 2018; Ottomanelli et al., 2021); and leverages the use of AT to enhance communication, job performance, and participation (Tassé et al., 2020). Additionally, AT offers job seekers

opportunities to learn and develop job-related and technology-related skills, which are prerequisites for much of today's modern labor market (Mahoehey et al., 2024). Many VR service providers state that they continue to use it post-pandemic (Butterworth, 2021; Mahoehey et al., 2024; Timmons et al., 2022).

Previous research has highlighted the significance of involving and collaborating with service providers and employers in the transition process into employment (Oertle & Trach, 2007; Sabbatino & Macrine, 2007; Tilson et al., 1994). Additionally, a lack of sufficient knowledge among employers on how to support employees with disabilities can also influence an individual's transition into employment (Kim, 2022). Family engagement is also essential for both transition planning and employment success (Hetherington et al., 2010; Winsor et al., 2021). When family members are involved and develop collaborative partnerships with VR service providers, the transition into employment is improved (Kramer et al., 2020).

### **Competitive Integrated Employment Outcomes for Transition-Aged Young Adults with Cognitive Disabilities: Assistive Technology and Supported Employment Services**

Employment is a critical milestone in the transition to adulthood, linked to financial independence, improved physical and mental health, overall well-being, and quality of life (McKee-Ryan et al., 2005; Okyere et al., 2021; Reichard et al., 2019; Schur, 2002; Shandra & Hogan, 2008). Individuals with disabilities who work in CIE benefit from enhanced economic, psychological, and physical health outcomes (Taylor et al., 2022). Specifically, those engaged in CIE earn higher wages (Blick et al., 2016; Butterworth et al., 2015), work more hours (Cimera, 2011), and have greater independence and self-determination compared to their peers in sheltered workshops or non-integrated inclusive work settings (Schall et al., 2020; Shogren et al., 2015). However, TAYA with cognitive disabilities often face challenges in finding and

maintaining CIE (Nord, 2020; Winsor et al., 2021; Chen et al., 2015; Kaya et al., 2021; Weld-Blundell et al., 2021; Newman et al., 2011). Despite valuing and striving to achieve employment success among this population, they often face challenges and require tailored VR interventions to prepare for, find, or retain jobs (Strauser, 2020). TAYA with cognitive disabilities can be successfully employed, when appropriately supported (Burgess & Cimera, 2014; McDonough & Revell, 2010). Wehman et al. (2014) concluded that SE is particularly beneficial for achieving successful employment outcomes for TAYA with cognitive disabilities. Research also indicates that AT services provided through state VR programs can enhance employment outcomes for this population (Chen et al., 2015; Kaya et al., 2016; Allen et al., 2010; Bross et al., 2019; Burke et al., 2013; Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Kuo et al., 2023; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010).

### **Relation to Occupational and Rehabilitation Science (ORS)**

Scholars have noted the detrimental effects of unemployment on health, well-being, social inclusion, independent living, and quality of life (McKee-Ryan et al., 2005; Chan et al., 2006; Lidal et al., 2007; Wanberg, 2012; Stauder, 2018). This dissertation adopts perspectives from both occupational and rehabilitation sciences to deepen our understanding of issues with access to AT support and employment.

### **Relation to Occupational Science (OS)**

Occupational science (OS) is an interdisciplinary field that studies human occupation, the importance of occupation for health and well-being, and the unique challenges individuals experience in their engagement in occupations (Molineux, 2010; Yerxa, 1990). The core premises of OS is that engagement in occupations could restore individuals' health and well-being. Otherwise, limiting occupations could result in poor health and well-being (Crepeau et al.,

2003; Kielhofner, 2009). AT has demonstrated potential in enabling engagement in meaningful occupation for individuals with disabilities (McGrath et al., 2017; Polgar, 2006; Larsen et al., 2018). Engagement in occupation is fundamental to life because it is through the active transactions with people in an environment that people develop a sense of competence, purpose, and belonging, which contributes to identity and creates meaning (Christiansen, 1999). My research focuses on the importance of engagement of individuals in CIE, which is employment that is performed in a competitive and integrated work environment where individuals develop a sense of competence. This focus aligns with Matuska and Christiansen's (2008) emphasis on the importance of engagement in occupations that promote personal growth and a sense of capability for achieving a life balanced that fosters positive health and well-being.

Integrated employment enables individuals with disabilities to expand their social networks, contribute to society, make choices and decisions, and be seen as a valued member of the community. This engagement fosters a sense of purpose and belonging (King, 2004). Matuska and Christiansen (2008) emphasized the importance of relationships for maintaining life balance, while Eakman (2014) highlighted that engaging in occupations that promote social connectedness satisfies psychological needs, leading to life balance and satisfaction. AT plays a role in facilitating social engagement (Larsen et al., 2018). Thus, access to AT is essential not only for enabling engagement in occupations but also for promoting social integration.

The concept of transactionalism, introduced by Virginia Dickie (2006), highlights the dynamic interactions between personal and external factors that influence engagement. This perspective acknowledges that occupational engagement is influenced not only by personal experiences but also by social, physical, environmental, and cultural contexts. My research

adopts a transactional approach by considering both personal factors and contexts influencing accessibility and CIE outcomes to understand how they impact engagement in occupations.

My research focuses on access to AT devices and services, closely tied to the concept of occupational justice (Hocking, 2017). Occupational justice advocates for all humans to have equal opportunities and resources to engage in occupations (Townsend & Wilcock, 2004). For people with disabilities, AT is a vital resource that enables them to fulfill their occupational roles (Arthanat et al., 2012). Larsen et al. (2018) highlight that AT provides necessary tools for engagement in occupations that might otherwise be inaccessible. Limited access to AT can lead to injustice by opportunities to work and be socially included. Ensuring equitable access to AT devices and services is crucial for promoting occupational justice and enabling individuals with disabilities to participate and engage in their chosen occupations.

The OS field developed from behavioral and social psychological perspectives that were sensitive to the subjective nature of human action, leading to the development of a client-centered approach (Kielhofner, 2009). This approach emphasizes the value of client empowerment by promoting accessibility, resources, and opportunities to engage in occupations that shape their lives (Townsend et al., 2003; Townsend & Wilcock, 2004). My research aligns with the principles of OS as it focuses on a client-centered approach by involving participants in research to explore their needs, challenges, expectations, and experiences with the provision of AT devices and services for equitable engagement in meaningful occupations.

### **Relation to Rehabilitation Science (RS)**

Rehabilitation science (RS) is an interdisciplinary field that studies human function and participation in life activities (Seelman, 2000). Stucki (2005) states that disability should be seen not only as a result of individual limitations but also as restrictions produced by the environment

that prevent individuals from fully participating in their daily activities. Baum (2011) states that disability is not a problem originating within an individual; instead, it exists when there is a poor fit between the person and environment. *The Future of Disability in America* concludes that disability is not an unavoidable consequence of injury and chronic disease but is shaped by the actions of individuals and environments (Field & Jette, 2007; Ottenbacher et al., 2012).

The IOM introduced the enabling-disabling process model in 1997 to help practitioners and researchers understand the dynamic nature of disability (Brandt & Pope, 1997). The model views disability as a process influenced by personal and environmental factors that can either enable or disable an individual's functioning and participation in life activities (Brandt & Pope, 1997). For example, access to appropriate AT support would be an enabling factor to mitigate the disabling effects of impairments, enabling individuals to participate in work activities. In the enabling-disabling process model, disability is not solely a result of an individual's health condition but is shaped by the interaction between personal factors (such as age, sex, income, education level, severity of disability, and employment status, etc.) and environmental factors (such as access to AT, services, and policy). My research examines how these factors enable or disable the function and participation of individuals with disabilities.

The WHO emphasized the value of AT as one of the primary categories covered under environmental factors in the International Classification of Functioning, Disability, and Health (ICF) model. The ICF model views disability as a dynamic interaction between a person's health condition, personal factors, and environmental factors (WHO, 2001). My research examines how personal factors (such as age, sex, income, race, and education level), health conditions (such as cognitive impairment), and environmental factors (such as AT, policy, and funding) interact to facilitate or hinder function and participation in life activities such work.

RS also plays a role in informing practices and policies that can create a more favorable environment for individuals with disabilities (Ottenbacher et al., 2012). By examining factors affecting the access to AT support services and employment among TAYA with disabilities population, my research sheds light on the challenges this population faces in gaining access to beneficial employment-related services. The findings will help inform policy and practice to mitigate barriers and increase accessibility, reducing the negative impacts of unemployment on the TAYA with disabilities population.

### **Purpose and Significance**

AT is a promising VR service to improve employment outcomes for TAYA with cognitive disabilities. Despite being the largest disability type among state VR program users, this population often experiences poor employment outcomes. AT services are underutilized, with apparent disparities in their utilization. Therefore, more research is required to provide a comprehensive understanding of the barriers, predictors, and facilitators of equitable access. In addition, there is little information on the new normal following the pandemic regarding the types of AT, the extent of their use, and how this is impacting CIE success. Collectively, the findings of this dissertation will provide empirical support that can inform policy and practice to improve employment outcomes among this population. This dissertation, through three research projects, aims to provide a comprehensive understanding of the challenges, influential factors, and potential mechanisms associated with the accessibility, utilization, and employment success among transition-aged population. Additionally, it will identify gaps and offer implications and recommendations for policymakers and VR personnel. These insights will promote the needed support, leading to optimized CIE outcomes for this population.

## **CHAPTER TWO: ASSISTIVE TECHNOLOGY SERVICES ACCESS FOR TRANSITION-AGED YOUNG ADULTS WITH DISABILITIES IN STATE VOCATIONAL REHABILITATION PROGRAMS**

### **Overview**

**Purpose:** Transition-aged young adults (TAYA) with disabilities frequently encounter high unemployment and underemployment rates. Assistive technology (AT) services have the potential to improve employment outcomes in state vocational rehabilitation (VR) programs, yet they are underutilized, with notable disparities in their utilization. This study aimed to examine how sociodemographic factors and their interactions predict the receipt of AT services for TAYA with disabilities.

**Methods:** This study is a retrospective analysis of national data collected by the Rehabilitation Service Administration's Case Service Report from fiscal years 2017-2019. The sample included 271,698 cases that reported having a disability, aged (18 to 24), and deemed eligible for VR services. We ran a multiple logistic regression analysis to examine the main and interaction effects of various sociodemographic variables on the likelihood of receiving AT services through VR programs.

**Results:** Less than 3% of TAYA with disabilities served by state VR programs in our study sample received AT services. The following client characteristics were associated with lower likelihood of receiving AT services for TAYA with disabilities: unemployed, minority, significant disability, older in age, TAYA with cognitive or mental health conditions, and not enrolled in post-secondary education (PSE). Our results suggest that AT services are underutilized, especially in facilitating the transition from high school or PSE into employment.

**Conclusion:** The findings underscore the need for further research to enhance VR AT services to better support employment transitions. Increasing AT training in rehabilitation educational programs and in-service training could enhance service utilization. Future research should focus on producing evidence to support the use of AT in vocational settings and guidelines for incorporating them into employment transition processes.

## Introduction

Navigating the transition from K-12 school to employment or post-secondary education (PSE) poses unique challenges for transition-aged young adults (TAYA) with disabilities, often confronting more educational and vocational barriers than their peers without disabilities. Previous research has consistently shown that TAYA with disabilities experience disproportionately high rates of unemployment and underemployment (Bureau of Labor Statistics, 2020; Carter et al., 2012; Hiersteiner et al., 2018) and lower participation in PSE (Cheng & Shaewitz, 2019; Grigal et al., 2014; Sanford et al., 2011; Shattuck et al., 2012). Completing K-12 education and securing employment are considered critical milestones in the transition to adulthood, and early work experiences during the transition from K-12 school to employment is a strong predictor for later employment success in life (Wehman et al., 2015). However, many TAYA with disabilities do not have the resources or support systems to overcome transition barriers so a considerable proportion of TAYA with disabilities are neither in PSE nor employed (Cheng & Shaewitz, 2019; Palmer et al., 2021). TAYA with disabilities ages 18 to 24 complete high school, enroll in PSE, and gain employment at lower rates than their peers without disabilities (Cheng & Shaewitz, 2019). TAYA with disabilities who are neither enrolled in PSE nor employed, experience greater health and financial risks (Belfield et al., 2012; Lewis & Gluskin, 2018). A notable legislative effort seeking to support TAYA with disabilities is the Workforce Innovation and Opportunity Act of 2014 (WIOA). Since 2014, federal and state policies have increased their focus on improving employment outcomes for TAYA with disabilities (Cheng & Shaewitz, 2021). The passage of the WIOA marks a significant transformation of the vocational rehabilitation (VR) landscape by enhancing the role of state VR programs in the transition process, increasing access to necessary supports and services during

the transition years, particularly for TAYA with disabilities facing barriers to accessing employment, education, training, and support services necessary for success in the labor market, and prioritizing competitive integrated employment (CIE) as the ultimate goal of state VR services (WIOA, 2014).

Previously, the Rehabilitation Act of 1973 marked a significant legislative milestone, authorizing state VR programs to promote independence, community integration, and employment for individuals with disabilities, asserting that disability is a natural part of the human experience and has no bearing on an individual's right to pursue jobs or to be fully included and integrated into society (Rehabilitation Act, 1973). The Rehabilitation Act was amended in 1986 (PL 99-506), 1992 (PL 102-569), and 1993 (PL 103-73), with each amendment emphasizing the benefits of Assistive Technology (AT) as a valuable tool that can be used to improve the lives of individuals with disabilities. The Assistive Technology Act of 1998, amended in 2004, has continued to emphasize the importance of AT and support the access to, availability of, and funding for AT services and devices, enabling individuals with disabilities to fully participate in employment, education, and daily activities (PL 108–364, 118 Stat. 1709) (Assistive Technology Act, 2004). The standard definition of an AT device is *“any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities”* (PL 108–364, 118 Stat, 1710). This broad definition covers any piece of technology that can assist an individual with a disability, including hardware, software, or universally designed mainstream technologies. AT services are defined as *“any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device”* (PL 108–364, 118 Stat, 1710). This assistance includes the evaluation of the

needs, acquisition/selecting of software or hardware device, and training on its use (34 CFR 361.5(c)(6)) (Rehabilitation Services Administration, 2017).

TAYA with disabilities who have access to AT services can be assisted in their transitions into employment by focusing on identifying the occupations or tasks where AT could be used to enhance their employment outcomes. This involves a comprehensive assessment that not only evaluates their needs but also considers client factors and the environment. This approach supports them in selecting and training on the specific AT that will optimize their performance and participation in their chosen tasks, ensuring that the solutions are tailored to both their personal and contextual requirements. Beyond addressing educational barriers, AT extends to employment, enabling individuals to perform job-related tasks independently, maximize independent living, communicate with others, and access a broader range of employment opportunities. The effectiveness of AT in enhancing work participation, performance, task completion, independence, communication, and overall employment outcomes is well documented in the literature (Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Lenker et al., 2013; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010). Studies also demonstrate that AT can be tailored to meet the specific needs of young adults transitioning from K-12 school to employment (Burgstahler, 2003; Bryant et al., 2012; Luckasson & Schalock, 2012). With the rapid development of technological solutions, the availability of applications for mainstream mobile devices has made implementing AT more practical, especially for those with cognitive limitations (Stephenson & Limbrick, 2015). Randall et al. (2020) suggest that using smartphones and other portable mainstream devices with apps could be a feasible solution to improve employment outcomes for young adults with cognitive limitations. Additionally, research indicates that video modeling and prompting techniques—

delivered via apps on smartphones or tablets—can be effective for learning job skills, training, and coaching, helping young adults with cognitive limitations enhance their job performance and independence (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013). Avail, a job training and coaching application, is an example of a recently developed tool specifically designed to help young adults with cognitive limitations execute job tasks and promote independence in the workplace (Kuo et al., 2023). JobTIPS is a dedicated application that helps individuals with cognitive disabilities improve workplace readiness, while Vocational Skills Curriculum by Conover Company enhances workplace readiness with tailored training and practical lessons. Simcoach Skill Arcade utilizes gamification to simulate real job tasks, offering a dynamic and engaging way to develop vocational skills. ClickUp offers task assignments, reminders, and progress tracking, and the Pomodoro Timer helps manage time by organizing work into focused intervals, enhancing productivity and concentration. Additionally, Trello and Asana provide task management to maintain organized and productive schedules. MindView Assist is beneficial in vocational settings, particularly for planning, simplifying task management, supporting memory recall, organizing thoughts and complex information, and structuring information. It also integrates seamlessly with Microsoft Office products and is designed to be accessible, featuring options like TTS. These are just a few examples among many applications available. Each of these applications on mainstream mobile devices exemplifies how they can be tailored to meet specific individual needs, enabling them to achieve greater independence and success in their employment endeavors.

The Human Activity Assistive Technology (HAAT) model can be helpful in guiding the AT support process and optimizing the outcomes of AT service delivery (Cook & Hussey, 1995). The HAAT is client-centered framework and emphasizes the interplay between the four

components: the human, activity, AT, and context. The human component focuses on the individual who will be using the AT. It includes an assessment of the person's abilities, limitations, and personal goals. This also includes an assessment of the person's psychological needs to ensure that the AT solution aligns with the individual's specific needs (Cook et al., 2020). To ensure better outcomes to the client, Scherer et al. (2007) and Wessels et al. (2004) emphasized the importance of addressing both the client's functional and psychological needs. The activity component of the HAAT model assists the understanding of the tasks in which the user of AT wants or needs to perform. It involves analyzing the demands of the tasks and identifying how AT can support the individual performance and participation in their chosen tasks. The AT component involves the selection of the AT itself. It includes evaluating AT options and determining which ones are most appropriate for the individual based on their needs, performances, and the activities they want to engage in. The selecting of AT should be tailored to fit the person's needs, abilities, expectations, and preferences to be useful to support the client's full potential (Cook et al., 2020). The HAAT model also considers the context in which the AT will be used. This includes the physical, social, and cultural environment that may affect the effectiveness of the AT use. Understanding the context helps in designing solutions that are practical and feasible in individual settings.

The AT support process should be both collaborative and client-centered, involving input from the client and participation of the client and other relevant professionals, such as rehabilitation professionals, VR counselors, physicians, employers, and funding source representatives (Cook et al., 2020; Scherer et al., 2005; Wielandt et al., 2006), and the client as central to a collaborative team of professionals (Smith et al., 2018). User involvement in the selection and decision-making process ensures the AT meets their needs and preferences, leading

to successful adoption (Scherer & Federici, 2015). AT that is recommended or prescribed without input from the user is less likely to be used to its full potential (Cook et al., 2020). Given that up to 30% of AT devices are not used or discarded by individuals within a year of adoption demonstrates the importance of including the user in the selection of the AT device (Scherer & Glueckauf, 2005). Access to training once the device is received ensures the client gains the full benefit of its use (Cook et al., 2020). The literature highlights that significant factors contributing to the non-use of AT are the absence of user involvement in the selection and decision-making process (Martin et al., 2011) and a lack of training and information provided to the user (Howard et al., 2022). TAYA with disabilities can improve their employment outcomes and other work performance outcomes if they are provided with the appropriate AT that meets their needs, trained in its proper use, and receive necessary work accommodations (Anand & Sevak, 2017; Brown-Triolo, 2002; Field & Jette, 2007; Shay, 2018).

Despite the research evidence demonstrating the benefits of VR AT services on achieving positive employment outcomes in state VR programs (Ahonle et al., 2020; Chiu et al., 2015; Duncan et al., 2020; Huang et al., 2013; Kaya et al., 2016; Sprong et al., 2019) and a growing body of literature supporting its use in improving employment outcomes (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013; Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Kuo et al., 2023; Lenker et al., 2013; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010), previous studies noted that AT services are underutilized in state VR programs, particularly among those VR clients with cognitive or mental health conditions. The literature recommended more training in AT for VR counselors (Arthanat et al., 2017; Barzegarian & Sax, 2011; Estrada-Hernandez et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006; Riemer-Reiss, 2003; Szymanski et al., 1993). These authors

emphasize the importance of training to increase individuals' access to AT services. Noll et al. (2006) noted that VR counselors are more likely to provide AT services when they have greater knowledge and training in AT. Similarly, Riemer-Reiss (2003) found a positive association between training and both access and referrals to AT services. The author also noted that many VR counselors employed by state VR programs have not received adequate AT training during their counselor education or had received short-term training. Furthermore, curricular standards in rehabilitation counseling programs often have few and generic AT training requirements (Arthanat et al., 2017). While some in-service VR counselors may pursue additional training, this is often neither required nor encouraged in VR settings (Kuo & Kosciulek, 2021).

Given the growing body of evidence highlighting the pivotal role of VR AT services in promoting positive employment outcomes, a knowledge gap exists concerning the reasons for limited access and utilization of VR AT services among TAYA with disabilities served by VR programs. Recognizing potential disparities is the first step in improving equity in access to these beneficial services. Moreover, examining the interactions between these sociodemographic factors provides insights and a more comprehensive understanding of the dynamics associated with the receipt of AT services in state VR programs for TAYA with disabilities. For example, minority status and more profound disabilities are both independent risk factors for not receiving AT services. By examining the interactions between these known risk factors, we can determine whether those barriers are simply additive or whether, together, they compound the lower likelihood of receiving AT services. Such an interaction should inform further exploration into why it exists and encourage targeted interventions to increase access to AT services for individuals in those intersecting groups. Thus, the purpose of the present study was to identify sociodemographic factors that may act as barriers to receiving AT services, as well as to examine

the interaction effects between these factors on the receipt of AT services among TAYA with disabilities who participated in VR program years from 2017 to 2019. These data over these three program years represent a time after WIOA was implemented in the state VR system and the COVID-19 pandemic had not yet had an impact on service operations.

## **Methods**

### **Sampling and Participants**

A retrospective cross-sectional study was conducted using de-identified RSA-911 Case Service Report data over three program years (2017-2019). The RSA-911 Case Service Report is administrative data, collected annually by state VR programs and submitted to the Rehabilitation Services Administration (RSA) office within the United States Department of Education. The dataset contains detailed records on all individuals who applied for and participated in VR services, when each case was opened and closed, sociodemographic information, disability type, VR services received, and employment outcomes achieved upon case closure (RSA, 2017). The dataset included 1,495,096 cases that exited the VR program years from 2017 to 2019. Of these cases, 603,117 exited as applicants, and 891,979 cases were deemed eligible for participating in VR services. The following inclusion criteria were applied to those eligible participants: (1) TAYA with disabilities between 18 and 24 years at the start of their VR programs, and (2) having a designated disability. After applying the inclusion criteria, a total of 271,698 cases met the inclusion criteria and were included in the final sample for analysis.

### **Dependent and Independent Variables**

Receipt of AT services was the dependent variable for the study. AT services are one of the VR services that are provided through state VR programs for individuals with disabilities, assisting them in the selection, acquisition, or use of devices. In RSA data, AT services includes

the use of devices and/or assistance in evaluating needs, acquiring a device, and training on the device. All AT services provided and purchased by VR programs or offered by comparable benefits providers for VR clients were consolidated into a single dichotomous variable: received AT services (yes/no).

We investigated nine sociodemographic variables commonly considered in disparities research: (a) age at start of VR program (continuous variable); (b) sex (male/female); (c) race/ethnicity classified into two categories based on minority status: minority (American Indian or Alaska Native, Asian, African, Native Hawaiian or other Pacific Islander, Hispanic) versus non-minority (White non-Hispanic); (d) educational level completed at application (special education, high school degree, less than a high school degree, some post-secondary/associate degree, bachelor's or higher degree); (e) enrollment in post-secondary education (PSE) at application (yes/no); (f) primary disability type (i.e., auditory, visual, mental, cognitive, physical), where auditory disabilities include both hearing impairments and auditory processing disorders (e.g., Tinnitus, Meniere's Disease, hyperacusis, and other auditory-related disorders), visual disabilities include both visual impairments and visual processing disorders (e.g., visual discrimination, visual sequencing, visual-spatial, visual closure, and other visual-related disorders), mental disabilities encompass mental health conditions such as depressive and other mood disorders, anxiety disorders, eating disorders, personality disorders, schizophrenia and other psychotic disorders, obsessive-compulsive disorder, and other unspecified mental illnesses, and cognitive disabilities encompass cognitive difficulties with learning, thinking, processing information, concentrating, remembering, filtering distractions, time management, planning, problem-solving, decision-making, communication, and social functioning such as intellectual disability, autism spectrum disorder, learning disabilities, attention-deficit/hyperactivity disorder,

and attention-deficit disorder; (g) significant disability (yes/no: significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment. An individual with a significant disability is an individual who has a severe disability that impacts their ability to obtain or maintain employment. Such individuals typically have complex needs and require more VR services than those with a non-significant disability); (h) employed at application (yes/no); (i) low-income status (yes/no: an individual is considered low income if they received assistance through the Supplemental Nutrition Assistance Program, the Temporary Assistance for Needy Families Program, or the Supplemental Security Income Program in the 6 months prior to application).

### **Statistical Analysis**

Descriptive statistics (e.g., frequencies, percentages) of the sociodemographic variables were generated for the sample and stratified by receipt of AT services (yes/no). Chi-square and independent t-test bivariate analyses were also performed to empirically examine differences between the two AT services groups for each of the nine sociodemographic variables. For inferential statistics, a multiple logistic regression analysis was performed using the binary AT services variable as the dependent variable (Howell, 2009). All nine sociodemographic variables were included in the model along with all possible interaction terms to examine the association with the receipt of AT services and their moderating effects on the receipt of AT services among TAYA with disabilities served by VR programs. Age was continuous variable and recentered at the lowest age value (18 years) before performing the multiple logistic regression analysis, and we used the sample's most normative group as our reference category. Before conducting the analysis, multicollinearity among the variables was screened. All correlations were  $<0.10$ , indicating that multicollinearity was not an issue among the variables. The odds ratios are

presented with 95% confidence intervals. All statistical analyses used a significance level of .05 and were performed using IBM SPSS Statistics for Windows (Version 29).

## **Results**

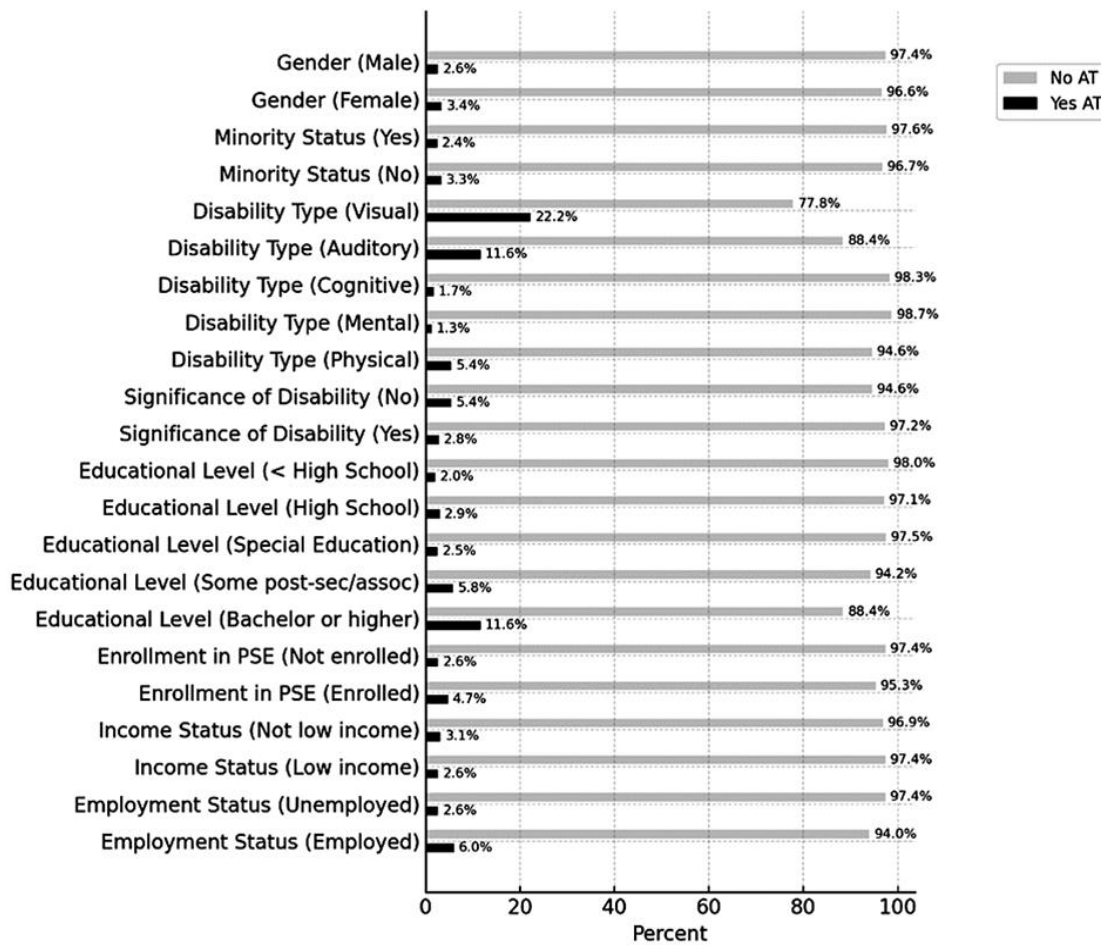
### **Descriptive Statistics**

The sample included 271,698 TAYA with disabilities ranging in age from 18 to 24 years old, with a mean age of 19.7 years and standard deviation (SD) of 1.90 years. A majority of the sample were males (60.7%), white non-minorities (57.2%), unemployed (90.5%), not classified as low-income (55.4%), had significant disabilities (97.1%), obtained a high school diploma (43.3%), and were not enrolled in PSE (87.0%). Of the individuals in the sample TAYA with disabilities served by state VR programs, TAYA with a cognitive disability made up the largest diagnostic disability type, accounting for more than half of the total sample (55.9%). Only 7,900 TAYA with disabilities (2.9%) received AT services. The group that received AT services displayed notable differences compared to those who did not, including a higher proportion of females (3.4%), white non-minorities (3.3%), employed (6.0%), those not classified as low income (3.1%), TAYA with visual disabilities (22.2%), those enrolled in post-secondary education (4.7%), and those obtaining a bachelor's degree or higher (11.6%). See Table 1 and Figure 2 for descriptive summaries.

Table 1. Descriptive statistics.

Study Variable	Total (n = 271,698)	Receipt of AT Services		p-values
		AT-no (n= 263,798; 97.1%)	AT-yes (n=7,900; 2.9%)	
<b>Age</b>				<.001
Mean (SD)	19.7 (1.90)	19.7 (1.89)	20.0 (2.07)	
<b>Sex</b>				<.001
Male	164,810 (60.7%)	97.4%	2.6%	
Female	106,522 (39.3%)	96.6%	3.4%	
<i>Missing=366</i>				
<b>Minority Status</b>				<.001
Yes	115,785 (42.8%)	97.6%	2.4%	
No	154,690 (57.2%)	96.7%	3.3%	
<i>Missing=1,223</i>				
<b>Disability Type</b>				<.001
Visual	5,985 (2.2%)	77.8%	22.2%	
Auditory	15,178 (5.6%)	88.4%	11.6%	
Cognitive	152,000 (55.9%)	98.3%	1.7%	
Mental	73,603 (27.1%)	98.7%	1.3%	
Physical	24,905 (9.2%)	94.6%	5.4%	
<i>Missing=27</i>				
<b>Significance of Disability</b>				<.001
No significant disability	7,839 (2.9%)	94.6%	5.4%	
Significant disability	263,849 (97.1%)	97.2%	2.8%	
<i>Missing=10</i>				
<b>Educational Level</b>				<.001
Less than high school degree	108,420 (40.4%)	98.0%	2.0%	
High school degree	116,316 (43.3%)	97.1%	2.9%	
Special education	16,240 (6.0%)	97.5%	2.5%	
Some post-secondary/associate degree	23,982 (9.0%)	94.2%	5.8%	
Bachelor's or higher degree	3,515 (1.3%)	88.4%	11.6%	
<i>Missing=3,225</i>				
<b>Enrollment in Post-secondary Education</b>				<.001
Not enrolled	236,229 (87.0%)	97.4%	2.6%	
Enrolled	35,265 (13.0%)	95.3%	4.7%	
<i>Missing=204</i>				
<b>Income Status</b>				<.001
Not low income	150,444 (55.4%)	96.9%	3.1%	
Low income	121,050 (44.6%)	97.4%	2.6%	
<i>Missing=204</i>				
<b>Employment Status</b>				<.001
Unemployed	245,775 (90.5%)	97.4%	2.6%	
Employed	25,717 (9.5%)	94.0%	6.0%	
<i>Missing=206</i>				

*Note.* p-values were obtained from independent t-test for age and Chi-square tests for all other comparisons.



**Figure 2.** Descriptive cluster bar of variables by the receipt of AT services.

### Logistic Regression Analysis

Overall, the model was significant;  $\chi^2 (108) = 10467.1, p < .001$ , and explained 20% (Nagelkerke  $R^2$ ) of the variance. The non-significant Hosmer and Lemeshow goodness of fit test indicated that the model fit the data reasonably well ( $p = .684$ ). The results of the multiple logistic regression analysis (regression coefficients, standard errors, Wald statistics, p-values, odds ratios, and 95% confidence intervals) are shown in Table 2.

Table 2. The logistic regression results for main and interaction effects on the receipt of AT services.

Variables	$\beta$	SE	Wald	df	Sig.	Exp( $\beta$ )	95% CI	
							Lower	Upper
Constant	-3.95	0.06	4250.55	1	<.001	0.02		
Age	-0.09	0.02	22.92	1	<.001	0.92	0.88	0.95
Sex (ref: male)	0.10	0.06	2.38	1	.123	1.10	0.97	1.25
Minority status (ref: white non-minority)	-0.40	0.07	34.77	1	<.001	0.67	0.59	0.77
Disability type (ref: cognitive)			788.98	4	<.001			
Visual	2.32	0.10	572.32	1	<.001	10.20	8.44	12.34
Auditory	1.13	0.09	156.73	1	<.001	3.09	2.59	3.69
Mental	-0.41	0.09	18.56	1	<.001	0.67	0.55	0.80
Physical	0.88	0.09	104.36	1	<.001	2.42	2.04	2.87
Significance of disability (ref: significant)	0.76	0.16	22.41	1	<.001	2.14	1.56	2.93
Educational level (ref: high school degree)			117.83	4	<.001			
Less than high school degree	-0.26	0.07	14.76	1	<.001	0.77	0.68	0.88
Special education	0.42	0.13	10.28	1	.001	1.53	1.18	1.97
Some PSE/associate degree	0.42	0.10	19.74	1	<.001	1.53	1.27	1.84
Bachelor or higher degree	1.31	0.18	54.41	1	<.001	3.72	2.62	5.27
Enrollment in PSE (ref: not enrolled)	0.87	0.08	129.52	1	<.001	2.38	2.05	2.76
Income status (ref: not low income)	-0.04	0.07	0.41	1	.524	0.96	0.84	1.09
Employment status (ref: unemployed)	0.30	0.10	9.71	1	.002	1.35	1.12	1.62
Age by Female	0.01	0.01	0.63	1	.427	1.01	0.98	1.04
Age by Minority	-0.02	0.01	1.56	1	.212	0.98	0.96	1.01
Age * Disability type			123.25	4	<.001			
Age by Visual	0.15	0.02	51.39	1	<.001	1.16	1.12	1.21
Age by Auditory	0.19	0.02	90.63	1	<.001	1.21	1.16	1.26
Age by Mental	0.02	0.02	0.70	1	.404	1.02	0.98	1.06
Age by Physical	0.12	0.02	38.28	1	<.001	1.13	1.09	1.18
Age by No significant disability	-0.04	0.04	1.13	1	.289	0.96	0.89	1.03
Age * Educational level			26.17	4	<.001			
Age by Less than high school degree	0.06	0.02	12.40	1	<.001	1.06	1.03	1.10
Age by Special education	-0.03	0.03	0.68	1	.408	0.98	0.92	1.04
Age by Some PSE/associate degree	-0.03	0.02	2.26	1	.133	0.97	0.94	1.01
Age by Bachelor or higher degree	-0.06	0.03	3.91	1	.048	0.95	0.90	1.00
Age by Enrolled in PSE	-0.05	0.02	7.99	1	.005	0.95	0.91	0.98
Age by Low income	0.01	0.01	0.67	1	.412	1.01	0.98	1.04
Age by Employed	0.08	0.02	21.42	1	<.001	1.09	1.05	1.13
Female by Minority	-0.01	0.05	0.06	1	.801	0.99	0.89	1.09
Sex * Disability type			55.20	4	<.001			
Female by Visual	0.01	0.08	0.01	1	.930	1.01	0.86	1.17
Female by Auditory	0.27	0.07	13.94	1	<.001	1.31	1.14	1.51
Female by Mental	0.00	0.08	0.00	1	.954	1.00	0.85	1.17
Female by Physical	-0.33	0.07	21.11	1	<.001	0.72	0.62	0.83
Female by No significant disability	-0.24	0.13	3.42	1	.065	0.79	0.62	1.01

Table 2. (continued)

Variables	$\beta$	SE	Wald	df	Sig.	Exp( $\beta$ )	95% CI	
							Lower	Upper
Sex * Educational level			0.36	4	.986			
Female by Less than high school degree	0.02	0.06	0.07	1	.786	1.02	0.90	1.14
Female by Special education	0.04	0.11	0.11	1	.738	1.04	0.83	1.29
Female by Some PSE/associate degree	0.00	0.07	0.00	1	.952	1.00	0.87	1.14
Female by Bachelor or higher degree	-0.05	0.12	0.14	1	.710	0.95	0.75	1.22
Female by Enrolled in PSE	0.00	0.06	0.01	1	.938	1.00	0.89	1.14
Female by Low income	-0.02	0.05	0.17	1	.681	0.98	0.89	1.08
Female by Employed	0.02	0.07	0.10	1	.749	1.02	0.89	1.17
Minority status * Disability type			59.87	4	<.001			
Minority by Visual	0.47	0.08	34.78	1	<.001	1.60	1.37	1.87
Minority by Auditory	0.50	0.07	45.14	1	<.001	1.65	1.43	1.91
Minority by Mental	0.17	0.09	3.76	1	.052	1.18	1.00	1.40
Minority by Physical	0.22	0.08	8.44	1	.004	1.25	1.08	1.46
Minority by No significant disability	-0.71	0.14	26.56	1	<.001	0.49	0.38	0.65
Minority status * Educational level			2.81	4	.591			
Minority by Less than high school degree	0.09	0.06	2.15	1	.143	1.10	0.97	1.24
Minority by Special education	0.03	0.11	0.05	1	.817	1.03	0.82	1.28
Minority by Some PSE/associate degree	0.09	0.08	1.34	1	.246	1.09	0.94	1.27
Minority by Bachelor or higher degree	0.05	0.13	0.13	1	.722	1.05	0.81	1.37
Minority by Enrolled in PSE	-0.30	0.07	20.31	1	<.001	0.74	0.65	0.84
Minority by Low income	-0.07	0.05	1.98	1	.159	0.93	0.84	1.03
Minority by Employed	-0.09	0.08	1.46	1	.226	0.91	0.79	1.06
Disability type * Significance of disability			109.56	4	<.001			
Visual by No significant disability	-1.23	0.29	18.04	1	<.001	0.29	0.17	0.52
Auditory by No significant disability	0.85	0.16	27.76	1	<.001	2.34	1.71	3.21
Mental by No significant disability	-0.73	0.31	5.49	1	.019	0.48	0.26	0.89
Physical by No significant disability	-0.99	0.23	18.05	1	<.001	0.37	0.23	0.59
Disability type * Educational level			53.86	16	<.001			
Visual by Less than high school degree	0.25	0.09	7.14	1	.008	1.29	1.07	1.55
Visual by Special education	-0.38	0.19	3.90	1	.048	0.69	0.47	1.00
Visual by Some PSE/associate degree	0.01	0.12	0.00	1	.964	1.01	0.80	1.26
Visual by Bachelor or higher degree	-0.51	0.20	6.45	1	.011	0.60	0.40	0.89
Auditory by Less than high school degree	-0.12	0.09	1.75	1	.186	0.89	0.75	1.06
Auditory by Special education	-0.57	0.18	10.53	1	.001	0.56	0.40	0.80
Auditory by Some PSE/associate degree	-0.03	0.11	0.10	1	.752	0.97	0.79	1.19
Auditory by Bachelor or higher degree	-0.47	0.20	5.30	1	.021	0.62	0.42	0.93
Mental by Less than high school degree	0.28	0.09	8.80	1	.003	1.32	1.10	1.58
Mental by Special education	0.09	0.18	0.24	1	.625	1.09	0.77	1.54
Mental by Some PSE/associate degree	0.04	0.12	0.10	1	.748	1.04	0.82	1.32
Mental by Bachelor or higher degree	-0.47	0.28	2.71	1	.100	0.63	0.36	1.09
Physical by <High School	0.21	0.09	5.42	1	.020	1.23	1.03	1.46
Physical by Special Ed	-0.20	0.18	1.32	1	.251	0.82	0.58	1.15
Physical by Some PSE/associate degree	0.03	0.10	0.08	1	.777	1.03	0.84	1.26
Physical by Bachelor or higher degree	-0.01	0.19	0.00	1	.972	0.99	0.68	1.44

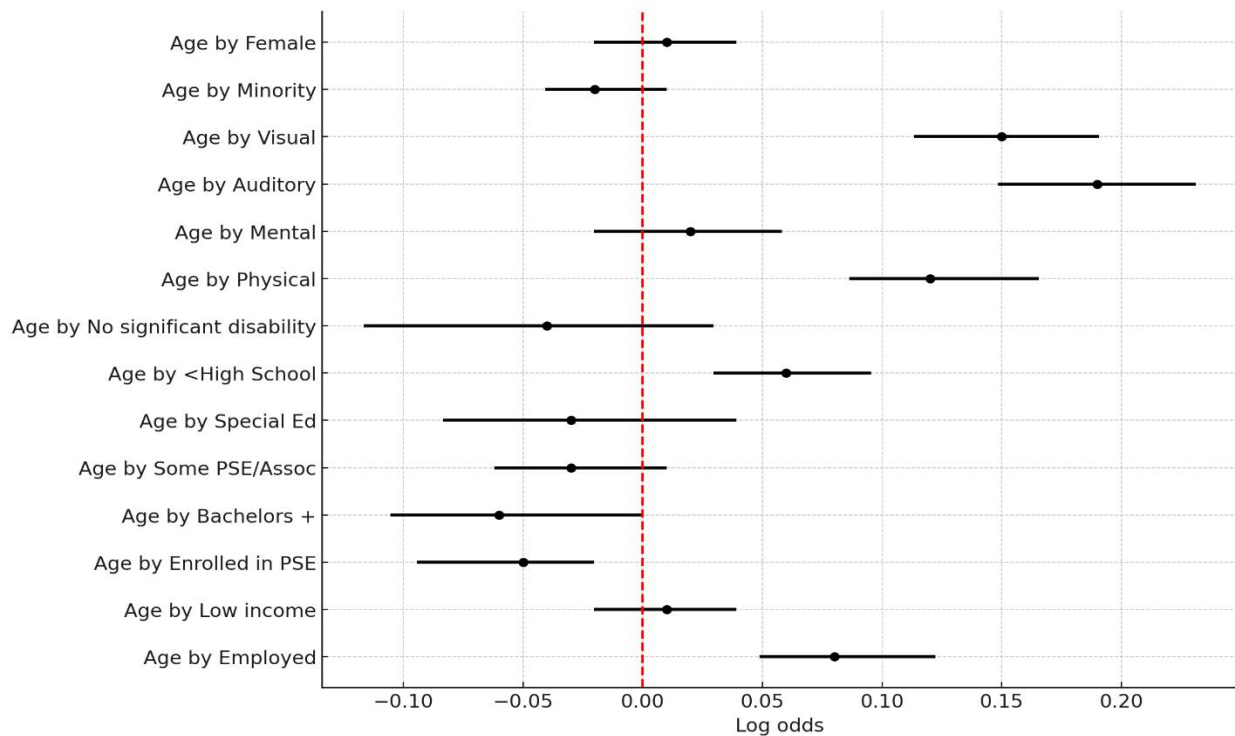
Table 2. (continued)

Variables	$\beta$	SE	Wald	df	Sig.	95% CI		
						Exp( $\beta$ )	Lower	Upper
Disability type * Enrollment in PSE			50.27	4	<.001			
Visual by Enrolled in PSE	-0.53	0.10	27.11	1	<.001	0.59	0.48	0.72
Auditory by Enrolled in PSE	-0.44	0.09	21.57	1	<.001	0.65	0.54	0.78
Mental by Enrolled in PSE	-0.01	0.10	0.02	1	.893	0.99	0.81	1.20
Physical by Enrolled in PSE	-0.42	0.09	22.16	1	<.001	0.66	0.55	0.78
Disability type* Income status			20.05	4	<.001			
Visual by Low income	0.10	0.08	1.49	1	.223	1.10	0.94	1.29
Auditory by Low income	-0.11	0.08	2.16	1	.142	0.89	0.77	1.04
Mental by Low income	0.00	0.08	0.00	1	.963	1.00	0.86	1.18
Physical by Low income	0.24	0.07	10.70	1	.001	1.27	1.10	1.47
Disability type * Employment status			129.63	4	<.001			
Visual by Employed	-0.11	0.12	0.84	1	.359	0.89	0.70	1.14
Auditory by Employed	0.84	0.09	79.68	1	<.001	2.32	1.93	2.79
Mental by Employed	-0.15	0.12	1.49	1	.223	0.86	0.67	1.10
Physical by Employed	0.05	0.11	0.22	1	.641	1.05	0.85	1.30
Significance of disability * Educational level			5.62	4	.229			
No significant by Less than high school	-0.15	0.17	0.79	1	.374	0.86	0.62	1.20
No significant by Special education	-0.20	0.42	0.22	1	.643	0.82	0.36	1.88
No significant by Some PSE/associate	0.30	0.16	3.31	1	.069	1.35	0.98	1.85
No significant by Bachelor or higher	0.14	0.30	0.23	1	.629	1.16	0.64	2.07
No significant by Enrolled in PSE	-0.05	0.15	0.10	1	.755	0.95	0.71	1.28
No significant by Low income	-0.16	0.14	1.37	1	.242	0.85	0.65	1.11
No significant by Employed	0.08	0.15	0.31	1	.578	1.09	0.81	1.45
Educational level * Enrollment in PSE			4.31	4	.365			
Less than high school by Enrolled in PSE	-0.13	0.08	2.57	1	.109	0.88	0.75	1.03
Special education by Enrolled in PSE	0.04	0.24	0.03	1	.854	1.05	0.65	1.67
Some PSE/associate by Enrolled in PSE	0.05	0.08	0.33	1	.568	1.05	0.89	1.23
Bachelor or higher by Enrolled in PSE	-0.11	0.15	0.58	1	.447	0.89	0.66	1.20
Educational level * Income status			15.82	4	.003			
Less than high school by Low income	-0.19	0.06	9.20	1	.002	0.83	0.74	0.94
Special education by low income	-0.06	0.11	0.29	1	.588	0.94	0.75	1.17
Some PSE/associate by Low income	0.12	0.07	2.65	1	.104	1.13	0.98	1.30
Bachelor or higher degree by Low income	-0.05	0.13	0.15	1	.697	0.95	0.73	1.23
Educational level * Employment status			7.16	4	.128			
Less than high school by Employed	-0.17	0.09	3.37	1	.067	0.84	0.71	1.01
Special education by Employed	-0.25	0.20	1.55	1	.214	0.78	0.53	1.15
Some PSE/associate degree by Employed	-0.17	0.09	3.44	1	.063	0.84	0.70	1.01
Bachelor or higher degree by Employed	-0.23	0.16	2.19	1	.139	0.79	0.59	1.08
Enrolled in PSE by Low income	0.06	0.07	0.73	1	.393	1.06	0.93	1.20
Enrolled in PSE by Employed	-0.20	0.09	5.04	1	.025	0.82	0.68	0.97
Low income by Employed	-0.13	0.07	3.16	1	.075	0.88	0.76	1.01

Note.  $\beta$  = Regression coefficients; SE= Standard error; Wald= Wald statistics; df= degrees of freedom; Exp( $\beta$ ) = Odds ratio; CI = Confidence interval; PSE= Post-Secondary Education; ref= reference category.

## Interaction Effects of Age

Age demonstrated interaction effects with several other independent variables (Figure 3). The effect of age by disability type (ref: cognitive) on receiving AT services varied significantly across different disability types ( $\chi^2(4) = 123.25, p < .001$ ). TAYA with visual ( $\beta = 0.15, \text{Exp}(\beta) = 1.16, p < .001$ ), auditory ( $\beta = 0.19, \text{Exp}(\beta) = 1.21, p < .001$ ), and physical disabilities ( $\beta = 0.12, \text{Exp}(\beta) = 1.13, p < .001$ ) had substantial increases in the odds of receiving AT services for each additional year of age, by 16%, 21%, and 13%, respectively. There was not sufficient evidence of differences between those with cognitive and mental disabilities ( $p = .404$ ). The interaction between age and educational level (ref: high school degree) was statistically significant ( $\chi^2(4) = 26.17, p < .001$ ). TAYA with disabilities with less than a high school degree showed a 6% increase in odds of receiving AT services ( $\beta = 0.06, \text{Exp}(\beta) = 1.06, p < .001$ ) with each additional year of age. However, age did not yield significantly different odds of receiving AT services for TAYA with disabilities with special education ( $p = .408$ ) or some post-secondary/associate degree ( $p = .133$ ). TAYA with disabilities with a bachelor's or higher degree had a 5% decrease in odds ( $\beta = -0.06, \text{Exp}(\beta) = 0.95, p = .048$ ) with each additional year in age. TAYA with disabilities who were enrolled in PSE had a similar 5% decrease in odds of receiving AT services for every one-year increase in age ( $\beta = -0.05, \text{Exp}(\beta) = 0.95, p = .005$ ), compared to TAYA with disabilities who were not enrolled in PSE. Employed TAYA with disabilities experienced 9% higher odds of receiving AT services with each additional year of age compared to TAYA with disabilities who were not employed ( $\beta = 0.08, \text{Exp}(\beta) = 1.09, p < .001$ ). There was not sufficient evidence to suggest that the effect of age on the odds of receiving AT services differed by sex ( $p = .427$ ), minority status ( $p = .212$ ), income status ( $p = .412$ ), or significance of disability ( $p = .289$ ).



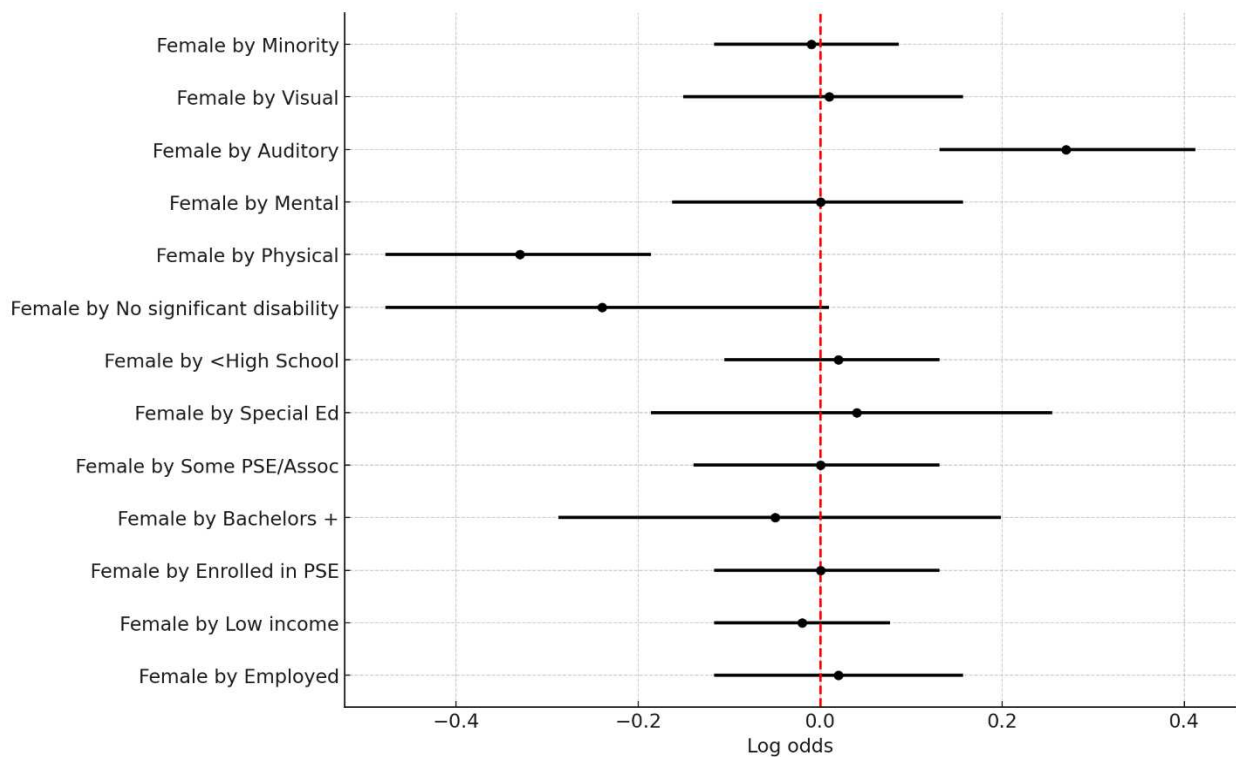
**Figure 3.** Forest plot of log odds of receiving AT services with 95% confidence intervals (CI) for interaction effects of age with other predictors.

*Note.* Each point represents the log odds for each interaction effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect (OR=1), positive effects (OR >1) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects (OR < 1) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

### Interaction Effects of Sex

The interaction effect of sex by disability type was statistically significant ( $\chi^2(4) = 55.20$ ,  $p < .001$ ), indicating that the effect of sex on receiving AT services varied across different disability types (Figure 4). When compared to males with cognitive disabilities, females with auditory disabilities were significantly more likely to receive AT services than males, showing a 31% increase in the odds ( $\beta = 0.27$ ,  $\text{Exp}(\beta) = 1.31$ ,  $p < .001$ ). Conversely, females with physical

disabilities were significantly less likely to receive AT services than males, with a 28% decrease in the odds ( $\beta = -0.33$ ,  $\text{Exp}(\beta) = 0.72$ ,  $p < .001$ ). There was not sufficient evidence of differences between males and females for those with visual ( $p = .930$ ) or mental disabilities ( $p = .954$ ). Additionally, there was not sufficient evidence to suggest that minority status ( $p = .801$ ), significance of disability ( $p = .065$ ), educational level ( $p = .986$ ), enrollment in PSE ( $p = .938$ ), income status ( $p = .681$ ), and employment status ( $p = .749$ ) differed in the odds of receiving AT between males and females.

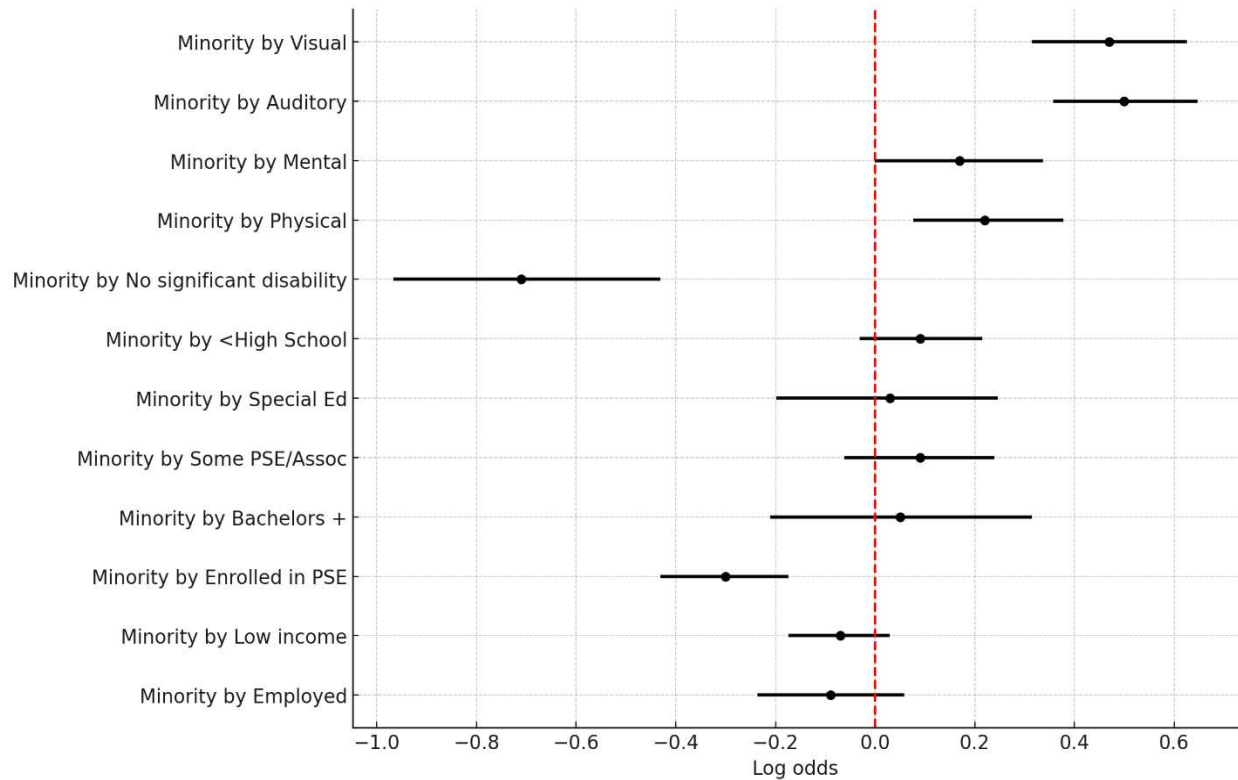


**Figure 4.** Forest plot of log odds of receiving AT services with 95% confidence intervals for interaction effects of sex with other predictors.

*Note.* Each point represents the log odds for each interaction effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect ( $OR=1$ ), positive effects ( $OR > 1$ ) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects ( $OR < 1$ ) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

## Interaction Effects of Minority Status

There was sufficient evidence to suggest an interaction effect of minority status by disability type ( $\chi^2(4) = 59.87, p < .001$ ), indicating that the likelihood of being a minority receiving AT services varied depending on disability type (Figure 5). When compared to non-minorities with cognitive disabilities, minorities with visual disabilities had 60% greater odds of receiving AT services ( $\beta = 0.47, \text{Exp}(\beta) = 1.60, p < .001$ ), and those with auditory disabilities had 65% higher odds ( $\beta = 0.50, \text{Exp}(\beta) = 1.65, p < .001$ ). Minorities with physical disabilities also showed a 25% increase in the odds of receiving AT services compared to non-minorities with cognitive disabilities ( $\beta = 0.22, \text{Exp}(\beta) = 1.25, p = .004$ ). However, there was not sufficient evidence to suggest a difference in the odds of receiving AT services between minorities and non-minorities with mental disabilities ( $p = .052$ ). There was sufficient evidence to suggest that minorities without significant disabilities were less likely to receive AT services than non-minorities with significant disabilities, with a decrease in the odds of 51% ( $\beta = -0.71, \text{Exp}(\beta) = 0.49, p < .001$ ). Additionally, minorities enrolled in PSE had 26% lower odds of receiving AT services compared to non-minorities not enrolled in PSE ( $\beta = -0.30, \text{Exp}(\beta) = 0.74, p < .001$ ). There was not sufficient evidence to suggest that minorities and non-minorities differed in the odds of receiving AT services by educational level, income status, or employment status ( $p$ -values = .591, .159, and .226, respectively).



**Figure 5.** Forest plot of log odds of receiving AT services with 95% confidence intervals for interaction effects of minority status with other predictors.

*Note.* Each point represents the log odds for each interaction effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect (OR=1), positive effects (OR >1) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects (OR < 1) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

### Interaction Effects of Disability Type and Significance of Disability

There was sufficient evidence to suggest that there was an interaction effect between disability type (ref: cognitive) and the significance of disability (ref: significant disabilities) ( $\chi^2(4) = 109.56, p < .001$ ). The odds of receiving AT services decreased by 71% for TAYA with insignificant visual disabilities ( $\beta = -1.23, \text{Exp}(\beta) = 0.29, p < .001$ ), 52% for insignificant mental disabilities ( $\beta = -0.73, \text{Exp}(\beta) = 0.48, p = .019$ ), and 63% for insignificant physical disabilities ( $\beta$

= -0.99,  $\text{Exp}(\beta) = 0.37$ ,  $p < .001$ ), compared to TAYA with significant cognitive disabilities. In contrast, TAYA with insignificant auditory disabilities had 134% higher odds of receiving AT services compared to TAYA with significant cognitive disabilities ( $\beta = 0.85$ ,  $\text{Exp}(\beta) = 2.34$ ,  $p < .001$ ).

The interaction effect of disability type (ref: cognitive) by educational level (ref: high school) on the receipt of AT services was statistically significant ( $\chi^2(16) = 53.86$ ,  $p < .001$ ). TAYA with visual disabilities that completed less than a high school degree had 29% greater odds of receiving AT services than those with cognitive disabilities that had completed a high school degree ( $\beta = 0.25$ ,  $\text{Exp}(\beta) = 1.29$ ,  $p = .008$ ). Conversely, TAYA with visual disabilities who had completed special education had a 31% decrease in the odds of receiving AT services compared to those with cognitive disabilities who had completed a high school degree ( $\beta = -0.38$ ,  $\text{Exp}(\beta) = 0.69$ ,  $p = .048$ ). Similarly, TAYA with visual disabilities who had completed a bachelor's or higher degree had a 40% decrease in odds of receiving AT services compared to those with cognitive disabilities that had completed a high school degree ( $\beta = -0.51$ ,  $\text{Exp}(\beta) = 0.60$ ,  $p = .011$ ). There was not sufficient evidence that TAYA with visual disabilities that had completed some post-secondary/associate degree differed in the odds of receiving AT services compared to those with cognitive disabilities that had completed a high school degree ( $\beta = 0.01$ ,  $\text{Exp}(\beta) = 1.01$ ,  $p = .964$ ).

There was not sufficient evidence that TAYA with auditory disabilities that completed less than a high school degree ( $p = .186$ ) or completed some post-secondary/associate degree ( $p = .752$ ) differed in the odds of receiving AT services from those with cognitive disabilities that had completed a high school degree. However, there was a significant 44% decrease in the odds of receiving AT services for TAYA with auditory disabilities who completed special education

compared to those with cognitive disabilities who completed a high school degree ( $\beta = -0.57$ ,  $\text{Exp}(\beta) = 0.56$ ,  $p = .001$ ). Similarly, TAYA with auditory disabilities who completed a bachelor's degree or higher had a 38% decrease in odds of receiving AT services compared to those with cognitive disabilities who completed a high school degree ( $\beta = -0.47$ ,  $\text{Exp}(\beta) = 0.62$ ,  $p = .021$ ).

For TAYA with mental disabilities, a lower educational level did not serve as a barrier, as evidenced by a 32% increase in the odds of receiving AT services for those with less than a high school degree compared to those with cognitive disabilities that had completed a high school degree ( $\beta = 0.28$ ,  $\text{Exp}(\beta) = 1.32$ ,  $p = .003$ ). There was not sufficient evidence that TAYA with mental disabilities who had completed special education ( $\text{Exp}(\beta) = 1.09$ ,  $p = .625$ ), some post-secondary/associate degree ( $\text{Exp}(\beta) = 1.04$ ,  $p = .748$ ), or a bachelor's degree or higher ( $\text{Exp}(\beta) = 0.63$ ,  $p = .100$ ) differed in the odds of receiving AT services from those with cognitive disabilities who had completed a high school degree.

TAYA with physical disabilities showed a similar pattern to those with visual and mental disabilities, where less than a high school degree was associated with a 23% increase in the likelihood of receiving AT services compared to those with cognitive disabilities that had completed a high school degree ( $\beta = 0.21$ ,  $\text{Exp}(\beta) = 1.23$ ,  $p = .020$ ). There was not sufficient evidence that TAYA with physical disabilities that had completed special education ( $\text{Exp}(\beta) = 0.82$ ,  $p = .251$ ), some post-secondary/associate degree ( $\text{Exp}(\beta) = 1.03$ ,  $p = .777$ ), or a bachelor's degree or higher ( $\text{Exp}(\beta) = 0.99$ ,  $p = .972$ ) differed in the odds of receiving AT services from those with cognitive disabilities that had completed a high school degree, indicating that having a higher educational level did not increase their likelihood of receiving AT services.

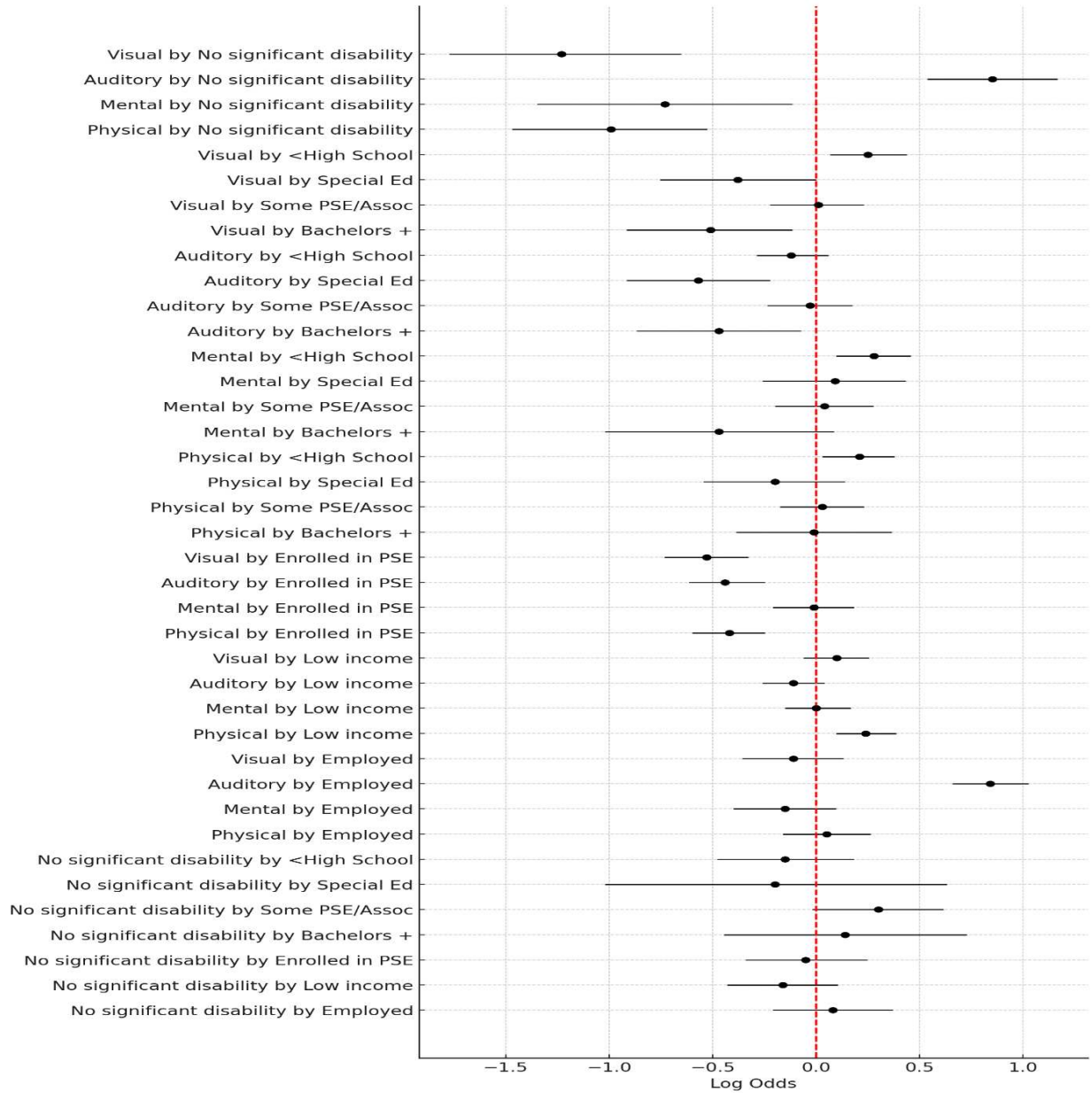
The interaction effect of disability type (ref: cognitive) by enrollment in PSE (ref: not enrolled) on the receipt of AT services was statistically significant ( $\chi^2(4) = 50.27$ ,  $p < .001$ ),

showing significant variations among disability types by enrollment in PSE. These results indicate how being enrolled in PSE is associated with the likelihood of receiving AT services for post-secondary students with visual, auditory, mental, and physical disabilities compared to TAYA with cognitive disabilities and not enrolled in PSE. For TAYA enrolled in PSE, those with visual disabilities were 41% less likely than TAYA with cognitive disabilities and not enrolled in PSE to receive AT services ( $\beta = -0.53$ ,  $\text{Exp}(\beta) = 0.59$ ,  $p < .001$ ). Similarly, TAYA with auditory disabilities enrolled in PSE were 35% less likely than TAYA with cognitive disabilities and not enrolled in PSE to receive AT services ( $\beta = -0.44$ ,  $\text{Exp}(\beta) = 0.65$ ,  $p < .001$ ), and TAYA with physical disabilities enrolled in PSE were 34% less likely than TAYA with cognitive disabilities and not enrolled in PSE to receive AT services ( $\beta = -0.42$ ,  $\text{Exp}(\beta) = 0.66$ ,  $p < .001$ ). There was not sufficient evidence that TAYA with mental disabilities enrolled in PSE differed in the odds of receiving AT services compared to TAYA with cognitive disabilities and not enrolled in PSE ( $\text{Exp}(\beta) = 0.99$ ,  $p = .893$ ).

The interaction effect of disability type (ref: cognitive) by income status (ref: not low income) on the receipt of AT services was statistically significant ( $\chi^2(4) = 20.05$ ,  $p < .001$ ). TAYA with physical disabilities who were classified as low-income had a significant 27% increase in the odds of receiving AT services compared to TAYA with cognitive disabilities who were not classified as low-income ( $\beta = 0.24$ ,  $\text{Exp}(\beta) = 1.27$ ,  $p = .001$ ), suggesting that low income may not be a barrier to AT services for this group. However, there was not sufficient evidence to suggest a difference in the odds of receiving AT services for TAYA with visual ( $\text{Exp}(\beta) = 1.10$ ,  $p = .223$ ), auditory ( $\text{Exp}(\beta) = 0.89$ ,  $p = .142$ ), or mental disabilities ( $\text{Exp}(\beta) = 1.00$ ,  $p = .963$ ) who were classified as low-income compared to TAYA with cognitive disabilities who were not classified as low-income.

Lastly, the interaction of disability type (ref: cognitive) by employment status (ref: not employed) on the receipt of AT services was statistically significant ( $\chi^2(4) = 129.63, p < .001$ ). TAYA with auditory disabilities and employed demonstrated a 132% increase in odds of receiving AT services than TAYA with cognitive disabilities and unemployed ( $\beta = 0.84, \text{Exp}(\beta) = 2.32, p < .001$ ). This indicates that employment was positively associated with the receipt of AT services for TAYA with auditory disabilities. There was not sufficient evidence to suggest a difference in the odds of receiving AT services for employed TAYA with visual ( $\text{Exp}(\beta) = 0.89, p = .359$ ), mental ( $\text{Exp}(\beta) = 0.86, p = .223$ ), or physical ( $\text{Exp}(\beta) = 1.05, p = .641$ ) disabilities compared to TAYA with cognitive disabilities and unemployed.

There was not sufficient evidence that the interaction effect of significance of disability on the likelihood of receiving AT services differed by educational level ( $\chi^2(4) = 5.62, p = .229$ ). This indicates that the effect of being an individual with or without a significant disability on the likelihood of receiving AT services did not differ among those with different educational levels. Similarly, there was not sufficient evidence that the interaction effects of significance of disability on the likelihood of receiving AT services differed by income status ( $\chi^2(1) = 1.37, p = .242$ ) or by employment status ( $\chi^2(1) = 0.31, p = .578$ ). See Figure 6 for visual summary of log odds with 95% confidence intervals for each interaction effect of disability type and significance of disability by other predictors.



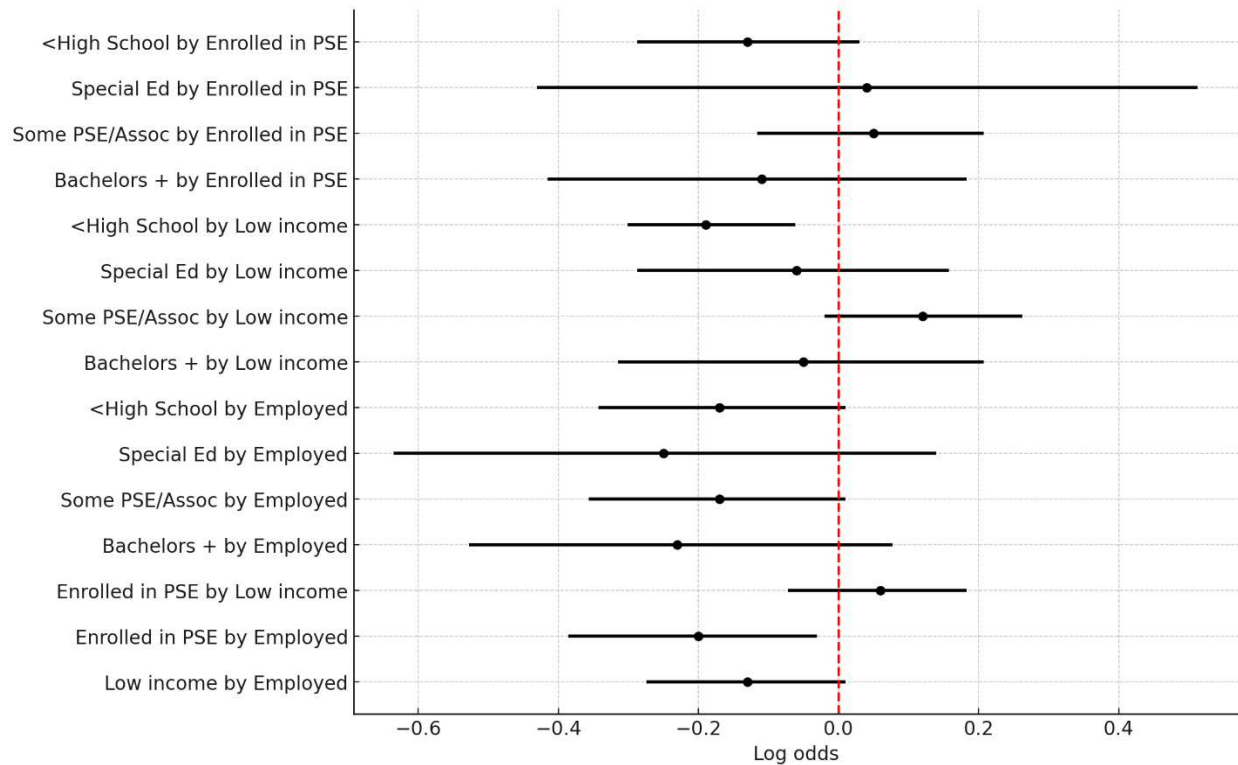
**Figure 6.** Forest plot of log odds of receiving AT services with 95% confidence intervals for interaction effects of disability type and significance of disability with other predictors.

*Note.* Each point represents the log odds for each interaction effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect (OR=1), positive effects (OR > 1) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects (OR < 1) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

### **Interaction Effects of Education Level, Enrollment in PSE, and Income Status**

The interaction effect of educational level (ref: high school) by enrollment in PSE (ref: not enrolled) did not show sufficient evidence to suggest a difference in the odds of receiving AT services ( $\chi^2(4) = 4.31, p = .365$ ). However, there was a significant interaction effect of educational level (ref: high school) by low-income status (ref: not low income) ( $\chi^2(4) = 15.82, p = .003$ ), indicating that the effect of educational level on receiving AT services varied between those with different income status. Specifically, TAYA with disabilities that had completed less than a high school degree and were classified as low income were 17% less likely than TAYA with disabilities that had completed a high school degree and not low income to receive AT services ( $\beta = -0.19, \text{Exp}(\beta) = 0.83, p = .002$ ). There was not sufficient evidence to suggest differences in the odds of receiving AT services for TAYA with disabilities that had completed special education ( $\text{Exp}(\beta) = 0.94, p = .588$ ), some post-secondary/associate degree ( $\text{Exp}(\beta) = 1.13, p = .104$ ), or a bachelor's degree or higher ( $\text{Exp}(\beta) = 0.95, p = .697$ ) compared to TAYA with disabilities that completed a high school degree and not low income.

Neither the interaction of educational level (ref: high school) by employment status (ref: not employed) ( $\chi^2(4) = 7.16, p = .128$ ) nor enrollment in PSE (ref: not enrolled) by income status (ref: not low income) ( $\chi^2(1) = 0.73, p = .393$ ) were showed sufficient evidence to suggest differences in the odds of receiving AT services. There was not sufficient evidence to suggest that the interaction effect of income status by employment status differed in the odds of receiving AT services ( $\chi^2(1) = 3.16, p = .075$ ). See Figure 7 for visual summary of log odds with 95% confidence intervals for each interaction effect of education level, enrollment in PSE, and income status by other predictors.



**Figure 7.** Forest plot of log odds of receiving AT services with 95% confidence intervals (CIs) for interaction effects of educational level, enrollment in PSE, and income status with other predictors.

*Note.* Each point represents the log odds for each interaction effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect (OR=1), positive effects (OR >1) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects (OR < 1) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

### Main Effects of Predictors on the Receipt of AT Services

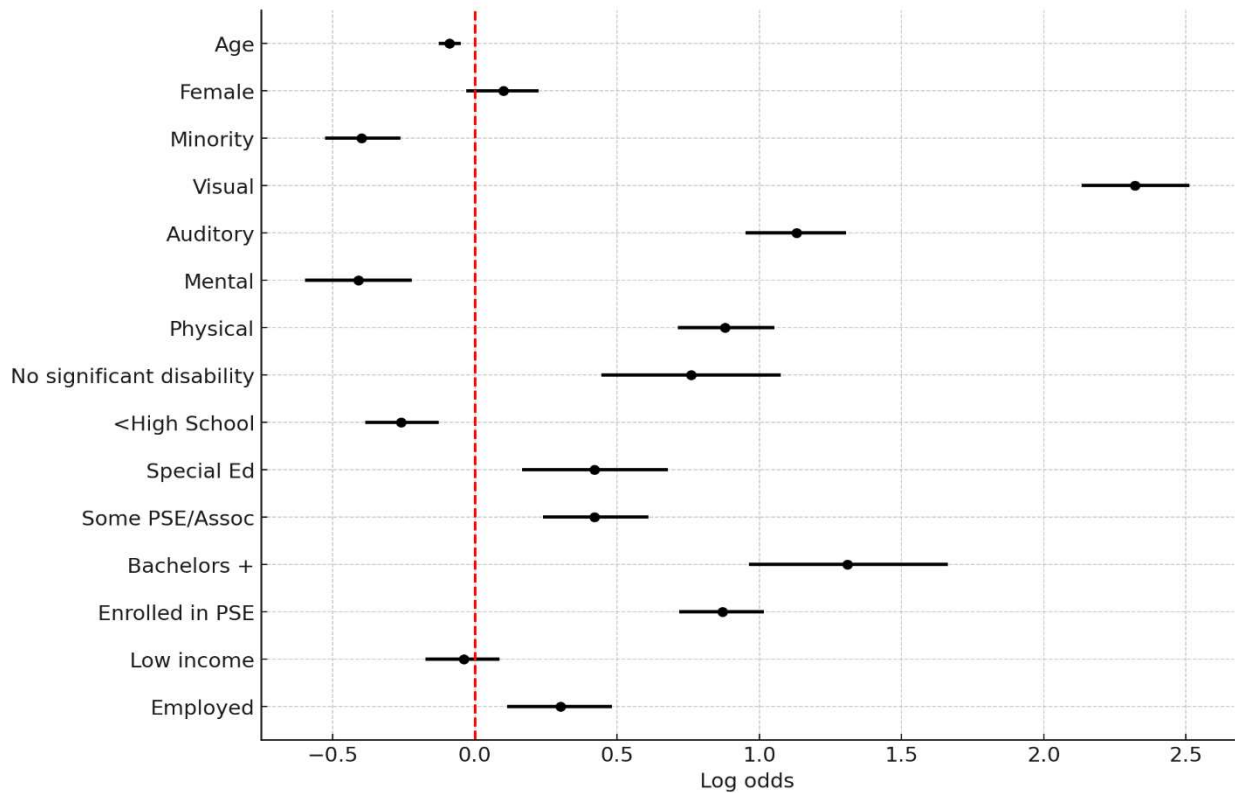
The logistic regression analysis revealed several statistically significant main effects among predictors associated with the receipt of AT services (Figure 8). Age was associated with an 8% decrease in the odds of receiving AT services for every one-year increase in age ( $\beta = -0.09$ ,  $\text{Exp}(\beta) = 0.92$ ,  $p < .001$ ). There was sufficient evidence that TAYA with visual disabilities demonstrated a substantial increase in the odds of receiving AT services, with an increase of

approximately 920% ( $\beta = 2.32$ ,  $\text{Exp}(\beta) = 10.20$ ,  $p < .001$ ). This significant positive association indicates that TAYA with visual disabilities were far more likely to receive AT services than those with cognitive disabilities. Following visual disabilities, TAYA with auditory disabilities ( $\beta = 1.13$ ,  $\text{Exp}(\beta) = 3.09$ ,  $p < .001$ ) and physical disabilities ( $\beta = 0.88$ ,  $\text{Exp}(\beta) = 2.42$ ,  $p < .001$ ) also showed increases in the odds of receiving AT services by approximately 209% and 142%, respectively. In contrast, TAYA with mental disabilities were associated with a 33% decrease in the odds of receiving AT services compared to TAYA with cognitive disabilities ( $\beta = -0.41$ ,  $\text{Exp}(\beta) = 0.67$ ,  $p < .001$ ). Additionally, TAYA without significant disabilities were more likely than TAYA with significant disabilities to receive AT services, indicating an approximately 114% increase in the odds of receiving AT services ( $\beta = 0.76$ ,  $\text{Exp}(\beta) = 2.14$ ,  $p < .001$ ).

There was sufficient evidence of a difference in the odds of receiving AT services among the education levels ( $p < .001$ ). TAYA with disabilities with less than a high school degree had 23% lower odds of receiving AT services compared to those with a high school degree ( $\beta = -0.26$ ,  $\text{Exp}(\beta) = 0.77$ ,  $p < .001$ ). Conversely, those who completed some post-secondary/associate degree ( $\beta = 0.42$ ,  $\text{Exp}(\beta) = 1.53$ ,  $p < .001$ ) and those that had completed special education ( $\beta = 0.42$ ,  $\text{Exp}(\beta) = 1.53$ ,  $p = .001$ ) had a 53% increase in odds of receiving AT services compared to those with a high school degree. Similarly, those that had completed a bachelor's degree or higher ( $\beta = 1.31$ ,  $\text{Exp}(\beta) = 3.72$ ,  $p < .001$ ) demonstrated a substantial 272% increase in odds of receiving AT services compared to those that had completed a high school degree. Furthermore, being enrolled in PSE was associated with a 138% increase in the odds of receiving AT services compared to those not enrolled in PSE ( $\beta = 0.87$ ,  $\text{Exp}(\beta) = 2.38$ ,  $p < .001$ ).

Employed TAYA with disabilities were 35% more likely than their unemployed counterparts to receive AT services ( $\beta = 0.30$ ,  $\text{Exp}(\beta) = 1.35$ ,  $p = .002$ ). Minority TAYA with

disabilities, compared to white non-minority TAYA with disabilities, were less likely to receive AT services ( $\beta = -0.40$ ,  $\text{Exp}(\beta) = 0.67$ ,  $p < .001$ ), indicating a decrease in the odds of receiving AT services by approximately 33%. Finally, there was not sufficient evidence to suggest a difference in the odds of receiving AT services between males and females ( $\text{Exp}(\beta) = 1.10$ ,  $p = .123$ ) or between those with different income statuses among TAYA with disabilities ( $\text{Exp}(\beta) = 0.96$ ,  $p = .524$ ).



**Figure 8.** Forest plot of log odds of receiving AT services with 95% confidence intervals (CI) for each main effect.

*Note.* Each point represents the log odds for each main effect, with a horizontal line indicating the 95% lower and upper CI. On the scale, zero represents no effect ( $OR=1$ ), positive effects ( $OR > 1$ ) are represented by points to the right of the vertical line, which indicate an increase in the likelihood of the outcome. Negative effects ( $OR < 1$ ) are represented by points to the left of the vertical line, indicating a decrease in the likelihood of the outcome. If the horizontal line does not cross the vertical line, the effect is statistically significant.

## Discussion

The purpose of this study was to examine the extent to which sociodemographic factors predict the receipt of AT services and to illuminate potential disparities in access to these services. The study also examined the interactions between these sociodemographic factors on the receipt of AT services to understand the complex dynamics associated with the receipt of AT services among TAYA with disabilities. A notable finding from the study is that only a small percentage (2.9%) of TAYA with disabilities received AT services. This low percentage may be partly explained by the persistent gaps in training, competencies, and preparedness among VR personnel, which have been consistently highlighted over the past three decades (Arthanat et al., 2017; Barzegarian & Sax, 2011; Estrada-Hernandez et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006; Riemer-Reiss, 2003; Szymanski et al., 1993). This lack of adequately trained VR personnel likely limits the availability of such services for clients with disabilities, particularly for those with mental and cognitive disabilities. Thus, there is a critical need for additional in-service AT training to equip VR personnel with the necessary skills for assessing clients' needs for AT services, appropriately matching AT to clients' needs, and providing effective training in the use of the selected AT. Such training would enable VR personnel to more effectively integrate AT services into the VR process, thereby improving employment outcomes for clients (Kuo & Kosciulek, 2021). Furthermore, there is an ongoing necessity to bolster pre-service AT training in VR personnel education by incorporating AT as a fundamental component of VR training curricula. This approach could address current deficiencies in AT training (Arthanat et al., 2017). Enhancing AT training would not only improve the comfort and competence of VR personnel in providing AT services but would also help to ensure a more equitable distribution, access, and utilization of AT services, supporting all

clients with disabilities who could benefit from such services. The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) offers training opportunities for in-service VR personnel to further their training and become a certified Assistive Technology Professional (ATP). VR agencies should facilitate these training opportunities, particularly when VR personnel lack the knowledge or skills to conduct AT evaluations or effectively utilize AT to support their clients.

Our study found that TAYA with cognitive disabilities, who constitute the largest subgroup of VR clients, received limited AT services from state VR programs. This observation aligns with prior research (Huang et al., 2016; Sprong et al., 2019), which similarly notes limited access to VR AT services for TAYA with cognitive disabilities within state VR programs. Chen et al. (2015) found that the state VR provided limited AT services, particularly for those with cognitive disabilities. Despite the increasing availability and development of devices and software applications designed to support young adults with cognitive disabilities, there is a potential perception that such services are not viewed as effective or worthwhile for improving employment outcomes by this population and their service providers (Kaye et al, 2008; Chen et al., 2015). This underutilization could also stem from a lack of client and professional awareness (MacLachlan et al., 2018; Ghaderi et al., 2023). The client and professional awareness of the benefits of AT can positively impact access and use (Field & Jette, 2007), thereby improving employment outcomes. Moreover, misconceptions about the capabilities of individuals with cognitive disabilities to utilize and learn about technologies and/or software applications may further restrict their access. Such assumptions can prevent this underserved group from being introduced to and trained in using technologies that could enhance their employment prospects, independence at the workplace, and ability to perform job-related tasks. The lack of adequate

training thus becomes a barrier, preventing individuals with cognitive disabilities from fully benefiting from using technologies (Fleming et al., 2013). Funding for cognitive disabilities-related technologies may be more restrictive than sensory or physical disabilities-related technologies, compounding the challenges faced by this group. It is likely that a combination of factors, including a lack of client and professional awareness of available technologies, restrictive funding, inadequate skills in assessing this population's needs for AT services, and limited empirical support for the outcomes of AT in vocational settings, collectively form barriers that hinder access to AT services for this population.

Increasing age added to the discrepancy in receiving AT services between those with cognitive disabilities and all other disability groups. However, we also found that special education, a bachelor's degree or higher, or enrolled in PSE reduce the discrepancy between those with cognitive disabilities and those with other types of disabilities. This underscores the necessity for VR transition plans to prioritize enhancing access to AT and other VR services for younger individuals at lower educational levels to address educational barriers more effectively and improve their likelihood of PSE enrollment (Honeycutt et al., 2015). This finding aligns with the intentions of the WIOA of 2014, which provides federal funds and guidelines for state VR programs to increase service access for individuals at earlier ages with educational barriers, thereby enhancing their educational and subsequent employment prospects (Schroeder, 2014; Oertle & O'Leary, 2017). The literature highlights that many in this demographic experience significantly lower rates of PSE participation (Grigal et al., 2014; Sanford et al., 2011; Shattuck et al., 2012). Consequently, state VR programs often prioritize access to AT services for TAYA with disabilities who face significant educational barriers to better employment opportunities, career advancements, and higher wages (Rast et al., 2019). However, once educational barriers

are addressed by the respective PSE institutions or through state VR programs, the perceived need for ongoing AT service provision to support transitions from post-high school or PSE into employment diminishes, especially when individuals leave the education system and start looking for jobs. Under the Individuals with Disabilities Education Act (IDEA) Amendments of 2004 (Pub. L. No. 108-446, 118 Stat. 2647), students with disabilities are legally entitled to various services, including AT services, until they turn 22 or complete their secondary education (IDEA, 2004). The IDEA requires K-12 schools to include transition planning in the Individualized Education Plan (IEP) with the potential use of AT support. It also mandates state VR programs must collaborate with K-12 schools to facilitate the transition of these students. Once they reach this age or exit high school, they must meet new eligibility requirements to apply for AT services and other VR services as adults. Most PSE and VR agencies have their own criteria for determining eligibility for specific services (McDonough & Revell, 2010). In K-12 education, a team creates an IEP with the potential use of AT support under IDEA regulations. After completing K-12, there is no longer an IEP team to determine AT support and accommodations. This shift leaves those students to self-advocate for their needs as adults when creating their Individualized Plan for Employment (IPE) in state VR programs—a challenging leap for many TAYA with disabilities (Kartovicky, 2020).

In the context of state VR programs, it is typical for employed individuals who need AT devices and/or AT services to be referred to state VR programs as employment retention cases. Employment was significantly associated with likelihood of receiving AT services in our study. Moreover, employed TAYA with auditory disabilities were substantially more likely to receive AT services than those with cognitive disabilities. None of the other employment by disability type interaction terms were significant. Thus, it is important that VR clients receive AT and other

supports during their transition to employment. *"Students with disabilities face several longstanding challenges accessing services that may assist them as they transition from high school into postsecondary education or the workforce—services such as tutoring, vocational training, and assistive technology"* (U.S. Government Accountability Office, 2012, p. 1).

Research indicates that upon exiting school, a small minority of students transition to PSE (e.g., 2- or 4-year colleges), and a larger portion of students transition to the workforce (Burgess & Cimera, 2014; Shattuck et al., 2012). These individuals often have limited evaluations of their AT needs for employment (Chiu et al., 2015). Notably, this population is considerably underserved in terms of AT services that could enhance their prospects for obtaining CIE and entering the job market. In a recent study, Sprong et al. (2019) found that unemployed individuals who received AT services had a significantly greater chance of obtaining CIE than unemployed individuals who did not receive AT services at program exit. WIOA of 2014 emphasizes CIE as the primary goal of state VR programs, reflecting the ongoing challenges this population faces in achieving CIE, which is marked by consistently low rates (Carter et al., 2012; Taylor et al., 2021). These observations explain why current state VR transition plans, developed post-WIOA of 2014, heavily focus on utilizing AT services to address educational barriers. Thus, it is imperative to reevaluate and integrate AT support into state VR transition planning and support strategies to ensure that AT services effectively support the transitioning into both employment and/or PSE and address the diverse needs of TAYA with disabilities. This may help facilitate more successful transitions into employment, especially for those who are not engaged in either education system or employment and are actively seeking employment. Moreover, local workforce centers should be equipped and knowledgeable about AT and partner with state VR programs in the transition process. This collaboration, as emphasized under the WIOA Act of

2014, could enhance support and facilitate more successful transitions into the workforce for TAYA with disabilities.

Our study found that TAYA with significant disabilities had lower chance to receive AT services in state VR programs. Significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment. An individual with a significant disability is an individual who has a severe disability that impacts their ability to obtain or maintain employment. Such individuals typically have complex needs and require more VR services than those with a non-significant disability. Providing specialized AT solutions may be more difficult to prescribe, and/or those individuals may be expected to require extended services that exceed what state VR programs would cover for this population. According to Sprong et al. (2019), receiving AT services improved employment success at program exist for all individuals with disabilities, regardless of the severity of the individual's disability. Typically, individuals with significant disabilities who require long-term support are referred to state Medicaid waivers for extended VR services, limiting the ability to purchase or implement technological solutions for this population. Such Medicaid waivers have been primarily driven by the medical justification for funding (Wallace, 2011) and generally lack coordination with AT practical concepts such as individual choice, individual empowerment, independence, and disability prevention, which are inherent principles for implementation of AT solutions. Arthanat et al. (2017) noted that VR service providers' perceived competency was more evident when justifying eligibility for AT funding based on medical necessity, but not for functional, independent, environmental, or personal necessity. AT for the purposes of improving job performance, employment outcomes, function, empowerment, independence, and enhancing the quality of an individual's life are not necessarily related to medical necessity (Arthanat et al., 2017; Cook et

al., 2020; Howard et al., 2022; Wallace, 2011). Not surprisingly, the population with significant disabilities typically experiences more functional limitations, has greater complex needs, and requires specialized AT solutions than those without a significant disability. Thus, it should be noted that when conducting assessments, particularly for this population, a team-based approach is strongly recommended (Kuo & Kosciulek, 2021; Smith et al., 2018). The provision of AT service necessitates a collaborative approach when making decisions about assessment, acquisition, solutions, and overall service delivery (Cook et al., 2020). The role of VR professionals in the team approach is essential for identifying the needs of TAYA with disabilities and developing a transition plan to assist them in achieving their employment goals. Working with other rehabilitation professionals, employers, and funders to coordinate, purchase, and follow-up on services to ensure that clients receive the support they need, as well as discussing potential AT solutions, job accommodations and securing funding (Cook et al., 2020). Scherer et al. (2005) found that clients with disabilities experience significantly better outcomes and more effective use of AT when the case processes involve collaboration among rehabilitation professionals. This collaborative team approach is not only best practice but also ethical for rehabilitation counselors. Teamwork and interdisciplinary team collaboration are included in the code of professional ethics for certified rehabilitation counselors with one of the ethical obligations of the certified rehabilitation counselor being to *“promote mutual understanding of rehabilitation plans by all team members cooperating in the rehabilitation of clients”* (p. 19) (Commission on Rehabilitation Counselor Certification, 2023). Working within a team offers a mix of AT solutions, knowledge, and skills for delivering appropriate AT services to those with complex needs (Smith et al., 2018). More research is needed to investigate the challenges and benefits of applying a team-based approach to the provision of VR AT services.

Including higher education/PSE personnel as part of this team could enhance collaboration between state VR programs and educational institutions, leading to increased access to the needed AT supports and services for improving students' transitions.

Our study reveals that TAYA with disabilities who are from minoritized groups were less likely to receive AT services. This finding is consistent with other VR studies highlighting the limited access of minoritized groups in receiving services within the VR system (Capella, 2002; Wilson, 2002; Bellini, 2003; Wilson & Senices, 2005; Sprong et al., 2015; Yin et al., 2022). Our results further highlight that minoritized groups, irrespective of whether they have significant disabilities or their enrollment in PSE, were less likely to receive AT services. Moreover, among this population of TAYA with disabilities, minoritized groups with cognitive disabilities were having even lower chances of receiving AT services compared to those minoritized groups with other types of disabilities. The disparity in service provision to minoritized groups, highlighted in a recent study by Yin et al. (2022), indicates that minoritized groups apply for VR services at a higher rate than non-minorities but are less likely to meet VR eligibility criteria, and thus, have lower rates of receiving services.

We found that income status was not independently associated with receiving AT services. However, our results also indicate that low-income TAYA with physical disabilities are significantly more likely to receive AT services than those with cognitive disabilities. This pattern may be related to the process of proving eligibility for AT funding, possibly because these conditions can be more easily documented as medical necessity (Canning, 2005; Cook et al., 2020). Our study findings also point to a significant impact on TAYA with disabilities with lower levels of education and income, underscoring the compounded barrier encountered by those TAYA with disabilities in accessing AT services. A national study by Kull et al. (2019)

noted that young adults aged 18 to 25 who experienced low-income status were over 60% less likely to be enrolled in the education system compared to their peers of the same age. This discrepancy is likely due to the conditional problem of accessing education systems for the availability of AT services, further aggravating the challenges encountered by this group.

## **Implications**

Despite the many studies show that the provision of AT services positively predicts successful employment outcomes at program exit, these services remain underutilized overall, with apparent disparities in their utilization. There is a need to expand AT training within rehabilitation education programs and offer more AT training for in-service VR personnel to increase their competence to serve clients with diverse disabilities, particularly those with cognitive and mental health conditions. In addition to more pre-service and in-service training, state VR agencies need to put more emphasis on the importance of staff having skills in individualized AT evaluation, planning, and implementation to accommodate the transition needs of each client they serve. Providing training that allows VR personnel to become certified ATPs to better serve clients with AT services. VR personnel should be encouraged to use a team approach to ensure the most effective AT solutions are provided, particularly for those with significant disabilities who may face complex needs and substantial barriers. A collaborative team approach ensures that diverse expertise is leveraged to deliver the most effective AT solutions. There is a need to increase access to age-appropriate AT for young adults. This includes not only adapting mainstream technology to meet user-specific needs but also providing adequate training on how to utilize these technologies for access employment and performing job-related tasks. VR personnel should also work towards identifying alternative funding sources for AT and refining eligibility criteria to make AT devices and services more accessible and

develop effective means for educating less-informed clients about the benefits of AT and recognizing the limited access of minoritized groups to beneficial services within VR programs. Enhanced collaborative efforts among state VR programs, PSE institutions, and workforce centers are recommended to facilitate greater access to and use of AT, potentially improving client outcomes.

### **Study Limitations**

Our study is not without limitations. First, this is a retrospective observational study that is subject to confounding by unobserved variables. Therefore, the findings cannot be used to infer causality. Nonetheless, this study identified significant statistical relationships between sociodemographic factors and their interactions on the receipt of AT services. Second, the RSA-911 data have no information on the types of AT services (i.e., selection, acquisition, training) or type of AT devices. As a result, we were unable to identify how AT may vary across specific AT services and devices. Third, the data do not have information about the continued/discontinued use of AT services. Such information would highlight important information to improve the provision of long-term AT services and successful adoption of appropriate AT. Fourth, data used for this study were collected from various state VR programs at a national level and were recorded by many VR counselors, raising the possibility of recording errors. Despite these limitations, the study contributes valuable insights into the dynamics of AT service in state VR programs and highlights areas for further research and improvement.

### **Conclusion**

For TAYA with disabilities, access to AT can make the difference between not being able to work and having the necessary tools they need for successful transitions and achieving employment. Both the Rehabilitation Act and the AT Act emphasize technology as a valuable

tool and aim to increase access to and the use of AT among TAYA with disabilities for achieving employment outcomes. The WIOA of 2014 further reinforces this by mandating state VR programs to provide necessary services that help TAYA with disabilities prepare for, secure, retain, or regain CIE. Additionally, under this Act, federal funds increased to ensure this population receives the needed services to succeed in the labor market, with an emphasis on CIE as the primary goal of state VR services. AT services provided through VR programs can facilitate successful transition into employment and adulthood, improve CIE outcomes and other work performance metrics for many TAYA with disabilities. All state VR programs receiving federal funding are legally required to provide non-discriminatory access to AT services, regardless of age, sex, education, disability type, the severity of disability, or race/ethnicity. Among different disability types, visual, auditory, and physical disabilities were associated with a significantly higher likelihood of receiving AT services. When TAYA with disabilities leave the education system and start looking for jobs are less likely to access AT services, indicating AT services are under-emphasized for supporting job seeking needs or facilitating the transition from high school or PSE into employment. Other characteristics—specifically being older in age, minority, TAYA with cognitive or mental health conditions, those with significant disabilities, and unemployed— were also associated with lower likelihood of receiving AT services among this population of TAYA with disabilities.

## **CHAPTER THREE: ASSISTIVE TECHNOLOGY UTILIZATION AND SUPPORTED EMPLOYMENT FOR TRANSITION-AGED YOUNG ADULTS WITH COGNITIVE DISABILITIES DURING AND FOLLOWING THE COVID-19 PANDEMIC**

### **Overview**

**Purpose:** Virtual supported employment is an emerging service to support clients with disabilities, served by state vocational rehabilitation (VR) programs, in searching for, securing, and maintaining competitive integrated employment (CIE). This study explored perspectives and experiences of key supported employment (SE) stakeholder groups on transitioning to virtual supports and using assistive technology (AT) to support transition-aged young adults (TAYA) with cognitive disabilities during and following the COVID-19 pandemic.

**Methods:** Semi-structured focus group interviews with four supported employment stakeholder groups: VR policymakers and funders, VR service providers, employers, and TAYA with cognitive disabilities and their families. The focus group sessions were conducted virtually, video recorded and analyzed using thematic analysis.

**Results:** Themes were extracted from seven focus group sessions. Stakeholders conveyed positive overall experiences in virtual supported employment beyond the pandemic, describing multiple encouraging opportunities for improving service accessibility, inclusivity, and efficiency. Nevertheless, obstacles with access to AT, the internet, and inadequate training may continue to limit such opportunities, highlighting areas for improvement.

**Conclusion:** Virtual supported employment offers a promising solution to address service accessibility barriers. The pandemic prompted new approaches to better support clients. This shift has prompted the need for ongoing training to explore technologies for supporting job seekers, as the use of virtual support continues to be provided beyond the pandemic.

## **Introduction**

Supported Employment (SE) is a fundamental vocational rehabilitation (VR) intervention aimed at facilitating competitive integrated employment (CIE) for individuals with disabilities. SE is individualized to the strengths, abilities, interests, and informed choices of individuals with disabilities, assisting them in finding and maintaining CIE (Brooke et al., 2018). The concept of SE stemmed from a movement to provide more inclusive opportunities for individuals with disabilities. It gained formal recognition with the passage of the Rehabilitation Act Amendments in 1984 (P.L. 98-527), which aimed to help individuals with disabilities secure and maintain employment in mainstream settings (U.S. Department of Labor, 1984). It was further supported by various pieces of legislation, including the Americans with Disabilities Act of 1990, a landmark legislation that emphasized the importance of community integration and equal employment opportunities for individuals with disabilities (U.S. Equal Employment Opportunity Commission, 1990), and the Workforce Innovation and Opportunity Act of 2014 (WIOA, 2014), which emphasized job support and training and the integration of individuals with disabilities into the workforce. The WIOA of 2014 played an important role in facilitating the integration of individuals with disabilities into the workforce, particularly those with barriers to the education, employment, training, and support services they need to succeed in the labor market (Wehman et al., 2018). WIOA of 2014 defines SE services as services needed to support an individual with a significant disability. These services are provided, organized, and made available in such a way as to assist an individual to achieve CIE based on their needs as specified in an individualized plan for employment (IPE). SE services for individuals with disabilities under the age of 25 can be extended, if necessary, in order to achieve the employment goal outlined in the IPE (U.S. Department of Labor, 2014).

On March 11, 2020, the World Health Organization (WHO) declared the coronavirus disease (COVID-19) a global pandemic (Cucinotta & Vanelli, 2020). The pandemic led to an immediate shift of SE services to virtual. Individuals who were previously receiving in person supports needed access to basic hardware and software technologies to maintain continuous supports. However, there were some concerns about funding agencies authorizing virtual support and accessing mainstream mobile devices and applications for this transition-aged population with disabilities participating in SE because in-person supports were the standard. Historically, individuals with disabilities are significantly less likely to have access to technologies and the internet in comparison to individuals without disabilities (Anderson & Perrin, 2017; Fong & Swick, 2022; Perrin & Atske, 2021). More specifically, young adults with cognitive disabilities in state VR programs reported having limited access to technology (Alshamrani et al., 2023; Chen et al., 2015; Huang et al., 2016). Prior to the COVID-19 pandemic, many of the survey-based studies reported a barrier in effectively supporting clients with technology due to clients having limited access to technology and/or insufficient training on technology (Estrada-Hernández et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006). A recent national survey confirmed that limited funding for technology and inadequate knowledge and skills in effectively utilizing technology are enduring barriers (Tanis, 2021). In another national survey, Dallas et al. (2022) reported that many VR service providers experienced challenges in engaging with their clients, including a lack of training on technology, limited internet access, unsupported applications, and no access to devices. Pogoda et al. (2021) found challenges during the transition to virtual support and use of technology encountered by professionals providing SE services for veterans with disabilities. These challenges primarily

stemmed from professionals' lack of familiarity with technology in supporting their clients. Thus, barriers to training and access exist at both the individual and provider levels.

SE is traditionally provided in-person between a job seeker, a community rehabilitation provider (CRP), and an employer through three distinct phases: job exploration and discovery, job development, and job coaching (Schall et al., 2015; Wehman et al., 2018). Funding for SE services is typically provided by the state VR programs/Division of Vocational Rehabilitation (DVR) or state Medicaid programs under Home and Community-Based Services (HCBS) waivers for those who require long-term support (Drake & Bond, 2008). The In-person SE service model is well established in federal and state policy and decades of literature demonstrates its effectiveness in producing positive CIE outcomes for transition-aged population with disabilities (Wehman et al., 2014). A virtual SE service model may extend those benefits by providing more inclusive and accommodating support services that are better aligned with an individual's preferences and circumstances (Healy et al., 2023); addressing the shortage of support professionals in under-served areas (Ahonle et al., 2021); increasing engagement and timeliness of services with decreasing transportation barriers and associated costs (Embree et al., 2018; Ottomanelli et al., 2021); and leveraging the use of technologies in supporting individuals to enhance communication, improve job performance, and foster independence, thereby improving employment outcomes and reducing their reliance on support professionals (Tassé et al., 2020). The use of technology, including virtual video meeting platforms, mainstream mobile devices and applications, also provides opportunities for individuals to learn and develop job-related and technology-related skills, which are prerequisites for much of today's modern labor market (Mahoehey et al., 2024).

Virtual SE is a relatively new and emerging form of support service that uses technologies to support transition-aged population with disabilities across the phases of SE. This form of support service remains relatively unexplored in the literature and there is a knowledge gap regarding how technologies were selected, accessed, and utilized in supporting SE clients during the pandemic. The purpose of the current study was to explore the experiences and perspectives of key SE stakeholders on transitioning to virtual supports during and following the pandemic and to gain insight into how technologies were utilized to support transition-aged population with cognitive disabilities served by the Colorado VR program. This study sought to answer the following research questions: (1) What types of mainstream mobile devices and applications were used, and for what purpose(s) or phase(s) of supported employment? (2) What modifications to policy or funding were made to improve access to mainstream mobile devices or applications during and post-pandemic? (3) How were these technologies selected, and what role did participants play in the decisions? (4) Did participants perceive the use of technology in supported employment as a negative or positive experience? (5) Is there a perceived need for more improvements that can inform best practices moving forward?

## **Methods**

We conducted a focus group study with four stakeholder groups directly involved in supporting individuals with disabilities served by the Colorado VR program during and following the COVID-19 pandemic. The study utilized a qualitative descriptive design, as described by Bradshaw et al. (2017). This approach offers the opportunity to gather rich descriptions from and explore novel areas with study participants on which little may be known (Chafe, 2017; Sandelowski, 2010).

## **Sampling and Recruitment**

We used purposive sampling to ensure that the groups would include information from multiple and relevant perspectives (Parahoo, 2014). Purposive sampling involves selecting participants who possess the knowledge and experience relevant to the research topic and can provide valuable insights into the topic of interest (Ritchie et al., 2014). This sampling method allows researchers to select participants who likely offer the most pertinent information (Stewart & Shamdasani, 2014). We recruited individuals from four key stakeholder groups: (1) VR policymakers and funders, (2) VR service providers, (3) employers, and (4) VR clients with disabilities and their families. Participants were selected based on their direct experience and involvement in providing or receiving support during and after the COVID-19 pandemic and their indicated willingness to reflect on those experiences. The recruitment was facilitated through our collective networks of agency and community partners. Invitations to participate in the study were sent to participants via e-mail and all participants signed a written informed consent form via e-mail before participating in focus group sessions. This research was approved by the Colorado State University's Institutional Review Board.

## **Participants**

We conducted a total of seven focus group sessions with thirty-four participants across the four stakeholder groups. One focus group session was conducted with SE clients served by the state VR program and family members, totaling nine participants. This session included six European American TAYA (18-24 years old) with cognitive disabilities such as autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD), five men and one woman, and all had attained high school diplomas. Additionally, three mothers of the participants joined this session, providing a family perspective on the experiences of their children.

In some states, the provision of state VR services is provided directly by internal VR personnel, such as VR counselors. In other states, including Colorado, “external comparable benefits providers,” referred to as community rehabilitation providers, provide services for VR clients, and their services are paid for through state VR or Medicaid programs. Two focus group sessions were conducted with community rehabilitation providers. The first provider group session consisted of three participants: two men and one woman, all European American, from different counties within Colorado, with an average work experience of 15.3 years, ranging from 10 to 25 years. The second provider group session included five participants: two African Americans and three European Americans, one man and four women, from different counties within Colorado, with an average work experience of 8.9 years, ranging from 4 to 15 years. Given that funding is typically provided by the state VR or Medicaid program, two focus group sessions with policymakers and funders were conducted with five participants each. The first policymaker/funder group comprised European American women overseeing funding from the state VR program. The second policymaker/funder group consisted of European American participants, one man and four women, overseeing funding from the state Medicaid program.

Lastly, we conducted two focus group sessions with employers. The first employer group session consisted of four participants: one man and three women, all European American, representing businesses in caregiving, education, and retail within the state of Colorado. The second employer group session consisted of three participants: two men and one woman, all European American, representing businesses in transportation, delivery services, and agriculture within the state of Colorado. See Table 3 for descriptive summaries of each focus group.

Table 3. Focus group composition.

Stakeholder Group	No. Participant	Focus Group Demographics
1. Service providers	3	All European American; two men and one woman; with an average work experience of 15.3 years (range: 10-25 years).
2. Service providers	5	Two were African American and three were European American; one man and four women; with an average work experience of 8.9 years (range: 4-15 years).
3. Policymakers/funders	5	All were European American and women; overseeing funding from state VR program.
4. Policymakers/funders	5	All were European American; one man and four women; overseeing funding from Medicaid program.
5. Employers	4	All were European American; one man and three women; represented businesses in caregiving, education, and retail.
6. Employers	3	All were European American; two men and one woman; represented businesses in transportation, delivery services, and agriculture.
7. TAYA and family members	9	All six TAYA were European American and obtained their high school diplomas; five men and one woman; diagnosed with cognitive disability; ranged in age from 18-24 years; three mothers of participants.

### Data Collection

The interactive nature of focus groups facilitates richer and more nuanced insights than might be gleaned from solitary responses in one-on-one interviews (Morgan, 1997). Through the dynamics of group discussions, a diversity of viewpoints emerges, stimulating more comprehensive deliberation on the topic (Kitzinger, 2005). Participants can build upon,

challenge, or refine each other's perspectives, leading to a multifaceted understanding of the topic (Holloway & Galvin, 2017). The focus group sessions, each lasting between 45 to 75 minutes and comprising three to six members, were conducted from May 2022 to April 2023. This smaller group size allowed for more thorough expression and clarity of opinions (Holloway & Galvin, 2017; Morgan, 1997). Interviews were conducted using open-ended, semi-structured questions (See Appendix A), enabling participants to express themselves freely and giving facilitators the opportunity to ask follow-up or probing questions to elicit detailed responses (Brinkmann, 2013). All focus group sessions were hosted and recorded on Zoom or Microsoft Teams platforms.

Before conducting the first focus group session, we created guiding questions from searches of emerging literature and conversations with key stakeholders. The protocols all contained about 6-8 questions each, however, the interview questions were tailored to each stakeholder group based on their respective roles. For example, policymakers and funders were queried on policies and funding mechanisms related to technology access during and after the pandemic. Service providers were asked to share their experiences supporting their clients with technology, addressing how technology was accessed and received to meet the needs of their clients and employers. Employer questions centered on their response to technology use on the job site by individuals with disabilities and their experiences in supporting employees with disabilities with technology options in hiring practices, training, and improving the quality of work. Individuals with disabilities and family members were prompted with questions encompassing their support experiences during and after the pandemic. They were asked about the types of mainstream mobile devices and applications utilized, including those for accessing virtual supports, the role of service providers in supporting them with access to and use of

technology, challenges they face with technology, and their recommendations for future improvements. All facilitators and participants were provided with the interview guide via email prior to each focus group session. See Appendix A for the focus group-specific prompts.

The focus group sessions were facilitated by a research team member who was familiar with the particular roles of the four stakeholder groups and one or two secondary facilitators who took notes, asked follow-up and/or probing questions for clarity or further discussion by the participants. Each session was conducted in the same manner using techniques described by Krueger and Casey (2000). Before the interviews began, the primary facilitator opened each session by welcoming everyone, explaining the purpose of the study and focus group session, confirming the informed consent, assuring participants that their answers would be anonymous and confidential, and introducing the researchers and participants. Next, the primary facilitator asked the focus group interview guide questions in order, giving each participant an opportunity to comment, share perspective, interact with each other, and build on the responses of each other. After each question was answered, the primary facilitator would check-in to see if participants had additional thoughts and with secondary facilitators for follow-up and/or probing questions. The primary facilitator would then proceed to the next question. This approach allowed for clarification of ideas before moving forward in the discussion. All focus group sessions were video recorded.

Following the sessions, the video recordings were transcribed into text documents using Otter.ai software (Version 1.0). The transcriptions of each focus group session were reviewed and edited for accuracy. This involved listening to the recordings, reading the transcripts, editing transcription errors, and ensuring accurate attribution of quotes to individual participants. All transcripts were organized by time of speech, name of speaker, and role (i.e., participant or

researcher) such that participant's responses were clearly distinguished from researchers' questions. Finally, the accuracy of transcripts was verified by two different researchers who had attended the focus group sessions before beginning the process of data analysis.

### **Data Analysis**

The transcripts were imported into NVivo qualitative data analysis software (Version release 1.7.1) and analyzed according to the guidelines suggested by Braun & Clarke (2006) for thematic analysis. Vaismoradi et al. (2013) and Nowell et al. (2017) noted that thematic analysis provides a purely qualitative account of the data that is rich and well detailed. Before coding, two researchers read and re-read all transcripts to further immerse themselves in the data. In the second step, guided by the research questions, two researchers independently conducted the initial coding using NVivo qualitative data analysis software. After completing their initial coding analyses, they convened to discuss and reach a consensus on these initial codes. Following this discussion, a final codebook was created, with each consensus code clearly named and described. The codebook included a list of 44 distinct codes, each accompanied by multiple references, the number of transcripts each code appeared in, and a description of each code. Once the data was fully coded and the agreed-upon codebook was established, the process of identifying potential themes commenced. The two researchers used the codebook and began sorting and collating codes into potential themes using NVivo qualitative data analysis software. This third step involved grouping related codes that shared common underlying ideas, which formed the basis of potential themes. The fourth step entailed a meticulous review of the coded data extracts assigned to each potential theme. The two researchers evaluated whether the data grouped under each theme cohesively represented the meaning and checked for any emergent sub-themes. All themes and sub-themes were then vetted by the two researchers to ensure all

data were captured and to finalize themes and sub-themes. In the fifth step, the final themes and sub-themes were defined, named, and discussed by the two researchers and reviewed by the entire research team for discussion and consensus. Exemplar quotes were also identified by the two researchers and reviewed by the larger research team for consensus to ensure the best representation of findings.

### **Strategies to Enhance Trustworthiness**

This research used multiple strategies to enhance trustworthiness. First, we initiated and maintained an audit trail throughout the course of this study (Rodgers & Cowles, 1993). This included saving, dating, and organizing all documents related to the research processes. These documents served as a record of the research, allowing for write-up of the study sections while also providing the reader with detailed information about the steps and procedures taken. Second, monthly research meetings were held to allow time for debriefing to obtain reflection and input on the research processes (Spall, 1998). Third, the two analysts practiced reflexivity (Greenbank, 2003; Kingdon, 2005) by reflecting on their personal and professional biases; a summary paragraph was written and shared between both analysts. Fourth, data triangulation was employed by obtaining data across participant groups to examine data from different stakeholder groups. Lastly, researcher triangulation was also employed by using more than one data analyst to decrease bias in analyzing the study data (Patton, 1999).

## **Results**

The data were analyzed across participant groups using Braun and Clarke's (2006) six-phase framework for thematic analysis. Two main themes were identified (see Table 4). The first theme, *Technology adapted and utilized in SE during the Pandemic*, included two sub-themes, *Improving Access to Technology* and *Flexibility of Policies to Facilitate Virtual Supported*

*Employment Services*. The second main theme, *Opportunities to enhance SE services post-pandemic*, included the subthemes, *Maintaining Client-Centered Approach Post-Pandemic*, *Need for Technology Training Post-Pandemic*, and *Communication and Engagement of Employers for Technology Use at Worksite*. Participants quotations supporting each theme and sub-theme are described below.

Table 4. Main themes and subthemes.

Themes	Subthemes
Technology Adapted and Utilized in Supported Employment during the COVID-19 Pandemic	Improving Access to Technology Flexibility of Policies to Facilitate Virtual Supported Employment Services
Opportunities to Enhance Supported Employment Services Post-Pandemic	Maintaining Client-Centered Approach Post-Pandemic Need for Technology Training Post-Pandemic Communication and Engagement of Employers for Technology Use at Worksite

**Theme I: Technology Adapted and Utilized in Supported Employment during the COVID-19 Pandemic**

This theme demonstrates the adaptability of stakeholders in navigating pandemic-related changes, ensuring the continuation of supports. All stakeholders had to adapt immediately and utilize mainstream technologies in their practices to stay supportive, connected, and engaged. Smartphones, electronic documents, mobile software applications, and videoconferencing platforms were extensively utilized during the pandemic. Participants described creative ways to use smart phone apps to provide job coaching support to individuals. One service provider stated,

*“We had to find creative solutions. The Job Accommodation Network at the time really stepped up to help identify some of those different apps that individuals could use on their phones. And so different apps that were either free or kind of providing some coaching help. That was really before we had started implementing the use of Avail app.”* Another service provider described the use of the Avail smart phone app to provide job coaching and promote independence among clients with cognitive disabilities in worksite,

*“There were apps, specifically one app that is called Avail. It really streamlines the coaching process for a lot of our individuals. And we found that it was an amazing resource because they could still have job coaching and they did not need somebody there next to them in-person. You are able to help set them up for success in different ways by giving descriptions of their tasks, and time intervals of their tasks. And we saw kind of getting settled in their positions and weaning off our supports.”*

From the employer side, some employers utilized a smartphone app to offer their training and orientation, as one employer described, *“At our organization, we’ve changed our training and orientation procedures. So, we have Cornerstone Learning software app, which all employees have to get on to do certain trainings. This is also where our orientation is accessed.”*

Texting emerged as a newly sanctioned method of communication between service providers and their clients during the pandemic, and a preferred method over phone calls by many clients. This enabled clients to utilize built-in accessibility features on their smartphones such as speech-to-text or text-to-speech. A service provider explained this evolution, noting, *“They [clients] started to use more texting instead of phone calls. I have clients who use text-to-speech or speech-to-text to communicate because they cannot spell well. That’s just easier for*

*them. I think pre-pandemic, texting was not considered billable support like that is something done on the site, but it became a means of communication.”*

In addition, electronic documents were utilized by service providers to offer job training and coaching to clients. This allowed individuals to review the steps for doing their job tasks on smart phones, as one provider described, *“I actually use a word document or a PDF for job task analysis that I would send to clients, so they could use it on their smart phones and scroll through those steps if they needed to remember stuff for their job.”* Some service providers learned how to use Microsoft Teams or Google Classroom to make their materials available online so that individuals could participate in job training and coaching - *“I had to learn to move my materials online because typically, I was doing everything hands-on, and you know we go out to do activities in the community. And it was interesting to try to make those hands-on things available online.”*

Several videoconferencing platforms were learned and utilized among all stakeholders, including Zoom, Microsoft Teams, Google Meet, Skype, and FaceTime. As one service provider said, *“... just figuring out how the videoconferencing platforms work was step one before trying to provide our services through technology.”* These platforms became tools for communication (*“there was a communication first by phone calls and then as the pandemic wore on more, we learned and got into videoconferencing to make sure that communication was happening for those individuals who need support.”*) and for providing job development, as one provider said, *“we all had to learn to use videoconferencing. We used Zoom when we did job development, so that we would still be able to submit job applications online and meet with clients.”* Individuals with disabilities also learned and used several videoconferencing platforms - *“I was using Microsoft Teams, Google Meet, and sometimes Zoom. I was doing job interviews, university*

*class, and autism group therapy sessions which were all virtual.”* Another individual with disability shared,

*“We had to learn about technology and all that, and it was a challenge, but it was very helpful at the same time. I still use online videoconferencing platforms for work and classes. And I also use them to talk to friends that might not be able to get together in person. I think it definitely helped me adapt and get out of my comfort zones.”*

Employers also described their adaptations to new hiring practices that utilized technology. One employer stated, *“we have made several changes, and we are doing virtual job interview and orientation and that is a change in our hiring practice ... any interview would be done over zoom, Skype, or FaceTime, and I am still willing to do virtual job interviews.”*

Another employer added, *“We are more open to videoconferencing as an interview style with someone than we would have been before. When we hired our employees, we were more willing to do a zoom meeting for the job interviews. Whereas before I do not think we would have normally done that.”*

### **Subtheme I: Improving Access to Technology**

This sub-theme highlights the pivotal role and effort played by policymakers and funders in improving access to mainstream devices and software applications for clients with disabilities. At the onset of the pandemic, the policymakers in the Colorado state VR program recognized the importance of improving access to mainstream devices to ensure both clients and service providers had the necessary tools to participate in SE services. As a policymaker described,

*“... we provided access to a smartphone, which, of course, facilitates SE services in a lot of ways. It allows providers to text, jump on FaceTime, or Google Meet directly from their phone... Before the pandemic, a lot of the time computers or tablets were really focused on*

*individuals who were in an academic training program. During the pandemic, I think computers and tablets were being purchased for folks who weren't engaged in an academic training program. So, we loosened up our policies around purchasing a computer for individuals to ensure those supports were accessible.”*

Service providers commented on types of devices that were accessed and used by clients. As one service provider noted, *“most of the people that we are supporting have a smart phone, laptop or tablet that were provided through DVR [Division of Vocational Rehabilitation], and for a lot of individuals, it was easier for them to use their smart phones for communication and accessing support.”* The modified policy also included extending funds for technology-based job coaching and improving access to job coaching software applications, as one VR policymaker noted, *“we added technology-based job coaching to purchase the software licenses, and we do not limit it to Avail app; it could be any similar type of software app that would enable individuals to participate in a job coaching on their phone.”*

While the state VR program/DVR made improvements on access to mainstream devices and applications, challenges persist regarding such access within the Medicaid waivers. As a result, clients often turn to the state VR program for assistance in purchasing technology, utilizing it as a resource to overcome the limitations within Medicaid waivers. As one Medicaid policymaker commented,

*“I do not think from purchasing technology we did a good job because we do not have the right mechanisms for it. So, that has been a big barrier for us over the years... I really think that DVR was kind of one of our saving graces because people could kind of turn to DVR and say, "Hey, we need access technology to be able to do employment-related things," and DVR was able to help them with access.”*

Another policymaker added, *“from the Medicaid perspective, we get worried that we purchase individuals a piece of technology, and then they lose it or become dependent on it without a backup plan for replacement or updates when things go out.”* However, all participants in our Medicaid focus group session indicated enthusiasm for improving access within Medicaid waivers to better support individuals with disabilities through access to technology. For example, one participant pointed out several benefits to providing technology for their clients:

*“We need to do things differently and make sure people have access to technology they need. We need to figure out how we make the Medicaid waiver more effective at funding the technology for people who need it...I do think it is an important question about sort of long-term, how are we supporting access to technology? How do we sort of more broadly around supporting sort of like tech literacy and things like that because whether that is a tool or a skill that individual might need in order to access job coaching, it is also an important tool or skill to get a job.”*

## **Subtheme II: Flexibility of Policies to Facilitate Virtual Supported Employment Services**

This sub-theme highlights the role of policymakers and funders in facilitating the transition to virtual SE services during the pandemic. The VR and Medicaid policies for facilitating virtual SE services were unanimously described by providers as flexible policies. Such policies not only facilitated the shift to virtual support but also enabled service providers to offer support that was most suitable for their clients' situations during the pandemic. As one service provider commented, *“our DVR [office was] completely flexible to anything we suggested, we did not get any negative experience, and DVR funders were just open to do what we can in whatever way we can to support our clients. Medicaid funders as well were very accommodating like whatever way you need to do to communicate and job coach your clients,*

*you can bill it.*” In addition, participants described that most support and communication were provided through synchronous modes, involving real-time interactions through video, audio, or text. However, there was an awareness of the potential for asynchronous support. A funder acknowledged this aspect, stating, *“Honestly, I think the majority is synchronized. A lot of people might not know they can do that. These asynchronous supports are allowed and billed.”*

Medicaid policymakers and funders were instrumental in advocating for access to virtual SE services and maintaining unchanged service provider rates during the pandemic. This was particularly important for clients with disabilities to maintain their continuity of support.

Medicaid has an existing appendix in their regulations that allows states to request immediate amendments during emergency situations. As one Medicaid policymaker explained,

*“There is a piece of our waivers called appendix K. And so, when the COVID-19 pandemic hit, we used Appendix K, and it is still in effect. We really fought the battle to make sure that rate did not change for job development and job coaching. I think that helps with sustainability and people to stay engaged with SE services.”*

VR policymakers and funders mentioned that even before the pandemic, remote services were included in the fee schedule. This laid the groundwork for smoother access to SE services for clients during the crisis. A policymaker noted,

*“... the fee schedule has never prohibited services being provided remotely. Prior to the pandemic, a lot of people were not using remote services to the extent that we are now... DVR usually has the flexibility to be able to provide the service in a manner that is how the individual needs it, and how the individual prefers to receive that service.”*

## **Theme II: Opportunities to Enhance Supported Employment Services Post-Pandemic**

Participants have positive overall experiences toward using virtual supports in SE as an opportunity to improve service accessibility, inclusivity, and efficiency for serving individuals with disabilities. One of the most prominent benefits of virtual services is its potential to increase accessibility in under-served areas such as rural communities, as one participant suggested: “*we do not have enough distribution of service providers across the state. As people become more comfortable with use of technology, it gives us the opportunity to maybe have a service provider in one city serving someone in a rural community.*” Virtual technology has the potential to be more inclusive by empowering individuals with disabilities to choose the mode of support that best suits their preferences and needs. As stated by a service provider, “*when scheduling meetings, I offer all three options; in-person, Zoom, or phone call. And go by the client's preference. I think this leads to greater inclusivity, especially for people with disabilities of various kinds.*” Another service provider added, “*we can set up a Zoom, Microsoft Teams call, phone call, or whatever accessible ways that works for client.*” Employers also expressed openness to offering inclusive options in their hiring practices to accommodate potential employees' needs, as one employer commented, “*I feel like the options for job interviews, orientations, and some of the trainings have been beneficial, especially for individuals who are students and have a more stringent schedule. So, it has really been helpful to have that virtual option.*” Another employer said, “*we will accommodate anybody that wants to do virtual depending on their needs.*” To overcome barriers that some individuals with disabilities face with transportation. As one individual with a disability expressed, “*I do not have to worry about transportation because I'm not able to drive.*” A service provider added, “*we are able to schedule individuals quicker and work around individuals' schedules because they do not have to*

*factor in transportation and commute time for someone to get to our office.” Another barrier was the stigma associated with receiving on-site job coaching support for some individuals. As one individual with a disability described, “If you would benefit from job coaching but do not want somebody on-site with you. Ask if the job coach can do that because I tried that for a time, and I think that was more helpful than on-site.” A service provider explained,*

*“I had some clients that said, I do not like it when you show up because it makes me feel like I am dependent on someone. So, it made us look at job coaching differently; why do not we just do some of it via technology instead of showing up on the job site because that makes them feel stigmatized.”*

### **Subtheme I: Maintaining Client-Centered Approach Post-Pandemic**

Maintaining a client-centered approach is essential to address individual differences and needs, ensuring that technology selected is tailored to effectively support each client. The selection of technologies during the pandemic was driven by the immediate need for technology necessary to maintain service continuity during the statewide ‘shutdown’. Although stakeholders adapted to using technologies during the pandemic for supporting individuals, the direct involvement of individuals with disabilities in the decision-making process was limited. This lack of involvement in selection highlights an area for potential improvement in post-pandemic SE. One individual with disability highlighted this lack of involvement in selection, stating, *“I think there should be client-led. It should be led by the client who you're serving and not assume that one thing is going to work for one person that would work for another.”* A family member shared her son’s issues with virtual job development meetings, *“we try to meet as much as possible face-to-face because the virtual stuff distracts him with ADHD and sensory. He does not pay much attention if he got you online on the computer than face-to-face.”* One individual with

disability expressed her personal preference, citing her social nature and coping mechanism: *“I was using Microsoft Teams and Zoom, but I am a very social person and I felt like lost some of my skills to cope with my disability. I think it would have been very hard for me if I did need a job coach virtually because virtual is not my style.”* One service provider commented, *“people have grown along with technology, and it has become integral, but some still have preferences for in-person support.”*

Comfortability with technology use varied among individuals. As one service provider indicated, *“some people know how to use technology, some people do not know, and others are just like I do not want to use that.”* Another service provider shared, *“someone who is already in the job could pivot easier with technology for virtual training to change how to do things, but some of those starting a job, if they are not used to a job, that was hard to address virtually.”* Additionally, factors such as the lack of internet access or private space further complicated the use for devices and/or software applications, particularly those experiencing financial barriers, as described by a funder, *“It was not easy to stay in contact to keep people engaged when they did not have access to the basics like the internet or space available. Even with purchasing technology for them, what is the use of a computer if they do not have anywhere to plug it in or access the internet?”* While technology facilitated SE service continuity, it wasn't effective for all clients. Some clients preferred in-person meetings over virtual ones, and other clients were not directly involved in selecting their technology, leading to mismatches between the technology and their preferences and needs. Comfort levels with technology use varied among clients. Access issues, such as lack of internet, compounded these challenges, particularly for those facing financial barriers. These experiences faced by participants during the pandemic

highlight the need for maintaining client-centered approach in SE service delivery beyond the pandemic.

### **Subtheme II: Need for Technology Training Post-Pandemic**

The pandemic facilitated technology access to mainstream devices and applications for clients with cognitive disabilities, but training on how to effectively utilize these resources was not often provided for clients, highlighting an area for improvement post-pandemic. It was evident that training for clients was not adequately provided and access to technology alone was insufficient. Participants recognized this gap, as one participant suggested, *“even if individuals have access to technology, they usually would have needed somebody to train them on it. It was great that they offered access, but it was not as much help as we would have hoped.”*

Following the pandemic, participating policy makers and funders all saw a need for technology training and typically came to view such training as an opportunity for service providers to develop the learned skills. One policy maker claimed, *“the training that we require for our service providers is the ACRE [Association of Community Rehabilitation Educators] certificate training. So, the training focuses on a lot of ways of providing virtual services and showing different apps on the phone that an individual could use to do work and be independent.”* Another policy maker added, *“the neat thing about the pandemic is that ACRE training had to be offered. And we had service providers that were like, “I’m learning how to use technology. I’m learning how to do this. And I can translate that into my support time offering people”, and I think that’s been a unique benefit.”*

Most employers emphasized the need for technology training for individuals with disabilities, as noted by one employer, *“I think it is very important that individuals be included in new forms of technology launching and making sure that they are trained on it is very*

*important.*” Service providers noted that individuals with cognitive disabilities were not giving the opportunities to learn and use technology before the pandemic,

*“...There were a lot of people who did not think that individuals with cognitive disabilities could use and learn technology. We were all kind of learning together, but I think a lot of people we serve have not been given the opportunity to learn those things before ... we put our individuals at a disadvantage because we do not expect job coaches and job developers to push the envelope with people to find ways to utilize technology to be more independent and do all of those things.”*

Participating service providers all saw a need for technology training, viewing it as an opportunity to explore technologies that could enhance job coaching activities and better meet their clients' needs. One provider shared her experience about exploring a new app at the conference she attended, *“there is one app I learned about at the conference. It could really change the job coaching world out here.”* Another service provider mentioned leveraging training and education on technology for individuals, *“there is an app I learned yesterday that you can see where every bus is in the city. I did not even know this existed. So, I'm still educating myself so I can educate my clients.”* A family member highlighted the need for information on technology,

*“I did attend training sponsored by the state, and it was about employment for young adults who have any kind of disability. And one of the things they were saying was that there are lots of apps and other technology things that can help. And I was like I do not know anything about that. So, they were saying ask your service provider about apps.”*

### **Subtheme III: Communication and Engagement of Employers for Technology Use at Worksite**

This sub-theme highlights the attitudes of employers towards technology use in the workplace, especially in the context of job coaching. While all employers generally embraced technology use for conducting job interviews and orientations, they expressed reservations about the use of technology, such as smartphones and apps during work hours at the worksite. As one service provider mentioned,

*“I would say with employers, we just did not deal with enough technology with the people being in their job sites. They are not a huge fan of us using technology or having cell phones or apps or anything like that because they see it as if individuals on their phone, they are not doing what they need to be doing like they are playing on their phone.”*

Employers’ concerns were primarily about potential distractions and the impact on productivity, or that employees might spend much of their work hours engaged in virtual conversations with job coaches instead of focusing on their work tasks. Employers wanted to ensure that it did not disrupt employees' productivity, or *“being able to rely on technology without taking away from the time they are supposed to be completing a task,”* as one employer said. However, when the use of technology was clearly linked to enhancing productivity and work outcomes, employers were supportive of its use at worksites. An employer noted, *“If the service providers we worked with said we needed to use some technology for individuals with disabilities that would help with productivity, we would support it and do it, but we do not know what we might need that would create a better work environment.”* Effective communication and engagement of employers in the job coaching process play roles in addressing the barrier to some employees with disabilities using devices or software applications at their worksite. For example,

one service provider shared his experience of communicating and engaging the employer in process of job coaching,

*“I think from the employer side, there became an expectation for using technology unless communicated with employer. I would negotiate with the employer like; would it be okay if this person has their phone with them? Because some employers generally did not want their employees to have phones with them during work hours because of using it for personal use rather than completing their job tasks. And I would talk with employers about how I am using this to do a task analysis on the phone that can be helpful for this person. Often, I would actually get the employer being said like; hey, you broke down this job really well and I'd love to have that for other employees. So, I did find that they were open to it.”*

## **Discussion**

The present study explored perspectives and experiences of key SE stakeholder groups concerning the transition to virtual SE services, access technologies, training on their use, and the integration of technologies in supporting young adults with cognitive disabilities. Our focus group participants described how the COVID-19 pandemic forced them to rethink and innovate how they support job seekers to find and maintain CIE. The flexibility of policies to facilitate virtual support and technology access allowed service providers to be responsive to the unique needs and circumstances of each individual. For example, some video meeting platforms, like Microsoft Teams, offer many features such as real-time captions, transcription of recorded meetings, translation, turn on text telephone (TTY), high contrast mode, immersive reader to reduce distractions, and virtual/blur backgrounds to reduce distractions, making them more accessible than other platforms. This adaptability in policy and technology choice ensures that service providers can select the most suitable tools to meet the diverse needs of their clients.

Flexibility was key in supporting SE clients to successfully find and maintain CIE (Mahoehey et al., 2024). Notably, for the first time, state Medicaid funding agencies authorized virtual support for Medicaid waiver recipients (Wagner et al., 2022), while the state VR program enacted several policy modifications to improve access to mainstream devices (e.g., smartphone, tablet, laptop) and other software applications (Anderson et al., 2021). These technologies were intended for enrolled clients in academic training programs. However, during the pandemic, such technologies were being provided and accessed by job seekers who were not enrolled in such programs, expanding their reach to a broader range of clients seeking employment. During the pandemic, service providers embarked on innovative methods to provide job training and coaching support, notably leveraging smartphone applications like Avail, a job coaching application, which is tailored to assist young adults with cognitive disabilities in learning their jobs, executing their job tasks, and promoting their independence at work (Kuo et al. 2023). Research on video modeling and prompting techniques delivered via mainstream devices (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013) confirmed their efficacy in improving job skills and providing job coaching. Lessons learned from the pandemic about adaptive and innovative supports can be used to rethink and improve SE services post-pandemic (Mahoehey et al., 2024).

Access to mainstream devices has expanded communication options, particularly for those with communication needs, allowing them to select the methods that best suit their preferences and abilities. Many mainstream mobile devices have built-in accessibility features that address diverse user needs. However, it is crucial to ensure that users are adequately trained to utilize these features effectively. The type of mainstream mobile device matters, as built-in accessibility options are often more robust on the Apple operating system compared to Android.

This highlights the importance of considering the device type and operating system that is most suitable for users, as well as the importance of user training in accessibility. Additionally, texting became a newly billable means of communication between providers and their clients during the pandemic. This finding aligns with the results of Anderson et al. (2021), which similarly noted that young adults favor texting when communicating with their SE service providers during the pandemic as an easy and convenient means of communication. Texting, which was not a billable activity before the pandemic, offered clients access to built-in accessibility features such as Text-to-Speech (TTS) or Speech-to-Text (STT), empowering those individuals with reading, processing information, and verbal or spelling difficulties to effectively communicate (Wepener et al., 2021).

When applied in the context of employment for individuals with cognitive disabilities, TTS and STT offer a range of benefits and can be tailored to enhance their work performance, particularly in the areas of reading, writing, communication, spelling, understanding, and processing information, depending on the specific individual needs. TTS enhances accessibility, allowing these employees to access written content in auditory form, which is especially beneficial for those who struggle with reading comprehension or processing information. It helps improve understanding and retention of information by enabling them to hear work-related documents, emails, and instructions, thus reducing the cognitive load associated with reading and processing information. STT facilitates a simplified writing process, enabling employees with difficulties with writing, typing, or spelling to convert their spoken words into written text efficiently. STT also supports clear and effective communication by ensuring that spoken contributions are accurately converted to text, aiding in email communication and messaging. By supporting key aspects of their work—reading, writing, communication, and spelling—TTS and

STT not only accommodate specific cognitive challenges but also boost confidence and independence among employees with cognitive disabilities, allowing them to perform their work tasks more effectively and contribute positively to their professional environments.

Videoconferencing platforms are utilized for various purposes including learning job-related skills, accessing job training materials, providing job development, conducting job interviews and orientations, and maintaining regular check-ins and communications. Connolly et al. (2020) noted that service providers' favorable attitudes toward video conferencing, a sentiment echoed by our participants across the stakeholder groups expressing positive user experience for videoconferencing platforms.

Overall, the participants in our study perceived virtual SE positively, regarding it as the new norm for service delivery by circumventing many of the barriers associated with in-person service delivery. Research suggests that virtual support holds promise for increasing service accessibility, inclusivity, and efficiency in better serving clients with disabilities (Ahonle et al., 2021; Akemoglu et al., 2021; Hinton et al., 2023; Mahoehney et al., 2024; Ottomanelli et al., 2021; Tassé et al., 2020). While the virtual support was positively viewed by the participants in this study as encouraging opportunities for increased service accessibility, inclusivity, and efficiency, such support relies on access to technology and internet tools (e.g., mainstream devices, internet connection) and not all individuals with disabilities have stable and constant access to these tools (Hinton et al., 2023). Some study participants noted limited or no internet access for some individuals with financial barriers. These findings align with prior studies highlighting financial-related barriers to internet access (Anderson et al., 2021; Dallas et al., 2022; Ottomanelli et al., 2021). The urgency to maintain service continuity amid disruptions led to rapid utilization and access to technologies such as smartphone, laptops, tablets, and other

applications without sufficient training for both service providers and clients (Dallas et al., 2022), or consideration of SE service users in the technology selection process. Many service providers were compelled to offer their support services during the pandemic without prior training (Hinton et al., 2023).

While virtual support has made the services more accessible and available, it is important to distinguish this from the accessibility of the technology itself. Some service providers utilize electronic documents in multiple formats (PDF, DOC) to deliver task analysis, job training, and coaching via smartphones and Microsoft Teams, but without offering training resources to ensure document content and online learning platforms used are accessible. For instance, PDF documents are not usable by TTS software unless they are OCR'ed (Optical Character Recognition processed). This is particularly useful for making documents accessible and understood by TTS users. With the increased use of technology in this realm comes an increased need to vet the technology and the digital information/communication for accessibility. Ensuring that products and information delivered to clients by VR service providers are accessible to users of assistive technology. This lack of accessibility has made it difficult for some clients to navigate and understand the content effectively, highlighting a potential area needing improvement post-pandemic (Levine et al., 2022).

## **Implications**

In response to the unprecedented situation that prohibited in-person interactions during COVID-19, SE service providers pivoted to virtual support and significantly amplified their reliance on technologies in providing supports. This has persisted after the pandemic with a significant number of service providers opting to maintain virtual support (Froehlich et al., 2023; Hartley et al., 2023). Many of those policies of accessing technology and virtual support

remained in place after the pandemic restrictions waned, attributing to the growing comfort of clients and service providers with virtual support services (Adolph et al., 2021; Hartley et al., 2023; Oesterle et al., 2020). Owing to COVID-19 and the benefits of virtual support, more and more service providers are likely to incorporate virtual support into service provision (Hinton et al., 2023). The normalization of virtual support in SE services during the COVID-19 pandemic is expected to persist beyond the pandemic (Timmons et al., 2022). A recent qualitative study by Mahoehney et al. (2024) found that SE providers from ten states would continue to incorporate virtual support into SE services after the pandemic due to its convenience and accessibility, as well as for some clients to build job-related and technology-related skills. Our study reinforces these findings, as most participants interviewed expressed a desire to continue to offer virtual supports post-pandemic. However, study participants also discussed areas that need to be improved moving forward, especially related to training on technologies. Recent studies highlighted this concern, underscoring the importance of addressing the training of service providers in technology to effectively support their clients (Anderson et al., 2021; Dallas et al., 2022; Heman et al., 2022; Pogoda et al., 2021). Despite state VR program policies aimed at improving technology access, there is an inherent need highlighted by participants for training on technology. State VR programs and SE agencies should facilitate these training opportunities, especially when service providers lack the knowledge or skills to use technology to support their clients. Service providers in our study articulated an interest and enthusiasm in seeking out training opportunities to explore and learn about technology. As described by stakeholders, technology training is viewed as an opportunity to develop technology skills, explore software applications that may benefit clients, and leverage technology training and education for clients, family members, and employers. It will also be important for service providers to continue to

explore new technologies for supporting job seekers with disabilities beyond the pandemic, particularly when determining a job seeker's interests, strengths, and abilities at the outset of services (Mahoehey et al., 2024).

Moving forward, ethical considerations, especially regarding client privacy, should be factored into virtual service provision (Froehlich et al., 2023; Hartley & Bourgeois, 2020). Awareness of and equipping service providers with the ability to implement appropriate procedures to ensure client privacy and information protection should be included in service providers' training. Training on universal design (UD) may also be considered for service providers' training to maximize the benefits for all clients. UD is the process and strategic approach to make products, electronic contents, communications, and/or services accessible and usable by people of all abilities and diverse needs, including those with cognitive disabilities (McNamara & Stanch, 2021). It encourages inclusive options in providing a service and communicating with individuals through various modalities. For example, when delivering job development service through videoconferencing, providers need to consider if that modality is most appropriate for the client and their situation and change modalities as needed (Sheppard-Jones et al., 2021). This would effectively cater to the diverse needs, preferences, and communication styles of individuals. As service providers increasingly adopt virtual modalities and as reliance on technology grows, both benefits and challenges may arise for individuals with disabilities, underscoring the necessity for using UD (Levine et al., 2022; McNamara & Stanch, 2021; Sheppard-Jones et al., 2021). The underlying concept of UD aligns with the values that underpin SE to enhance inclusivity and accessibility (Levine et al., 2022). However, highlighted in Levine et al. (2021), UD is absent from the Code of Ethics and the Council for Accreditation of Counseling and Related Educational Programs (CACREP) Standards (2016). Incorporating

UD as a core component of VR would not only improve service delivery for clients but also empower service providers to navigate the increasing reliance on technologies more effectively for serving their clients post-pandemic (Levine et al., 2022; Sheppard-Jones et al., 2021). In addition to UD, it is imperative for service providers to evaluate the usability of the technology they employ from an accessibility standpoint. The use of technologies and digital information/communication may pose a significant risk of creating new barriers if their accessibility for different types of disabilities and compatibility with various assistive technologies are not ensured for users.

State Medicaid agencies have authorized virtual support for SE clients, yet many funded recipients still face barriers due to policy restrictions on funding for technology (Friedman, 2022). Virtual support can improve service accessibility, particularly those living in remote communities with limited options for in-person support (Adams et al., 2019; Mahoehney et al., 2024). Now, virtual support offers a solution for reaching the underserved communities, especially many young job seekers with cognitive disabilities in rural communities who often lack connection to employment and support services (Burd-Sharps & Lewis, 2017; Bray et al., 2016). Enhanced access to technologies not only improves service availability in these communities but also enables individuals to access more inclusive service delivery that meets their needs, preferences, and personal circumstances (Healy et al., 2023). It also contributes to enhancing tech literacy, empowering individuals to learn new skills and access more employment opportunities (Anderson et al., 2021; Izzo et al., 2010; Alshamrani et al., 2023; Chen et al., 2015; Huang et al., 2016). Future labor markets may provide further employment opportunities due to the growth of telework opportunities in recent years with higher wages and better job opportunities for many individuals with disabilities who are skilled in using and

navigating digital work environments (Ameri et al., 2023). However, a lack of access to technology and insufficient training on its use may restrict these benefits and employment opportunities (Fisher et al., 2021; Khanlou et al., 2020).

SE necessitates a client-centered approach that is individualized to the unique strengths, abilities, interests, and informed choices of individuals with disabilities (Brooke, et al., 2018; Drake & Bond, 2008; Kostick et al., 2010). Maintaining a client-centered approach in SE service delivery moving forward is essential, and client preferences should be central in the decision-making process for selecting technologies and structuring service delivery. This approach ensures that support services are tailored to meet the unique needs and circumstances of each client. The virtual model is one component of holistic service delivery that emphasizes a client-centered approach and expanding the use of technologies for better supporting job seekers in finding and maintaining CIE beyond the pandemic.

### **Study Limitations**

There are several limitations to consider in interpreting our findings. First, the study conducted one focus group with TAYA with cognitive disabilities and their families. Future research can interview more individuals to understand better the perspectives of the individuals who receive those supports and present a better basis for considering new directions the field may take in supporting this population. Second, the findings of this study are descriptive in nature to allow for exploration of perspectives and experiences of key stakeholder groups. Hence, caution is warranted in generalizing their experiences and perspectives to the larger population. While our investigation was an important first step in understanding the transition to virtual SE and the use of technologies in assisting TAYA with cognitive disabilities, it also generated new questions and future research opportunities. Third, the data presented reflects the

experiences of key stakeholder groups in metropolitan areas of Colorado, which may not be representative of non-metropolitan or rural communities where access to SE is often limited.

### **Conclusion**

The COVID-19 pandemic ushered in an era of increased service accessibility and inclusivity, breaking down service barriers that were once challenging to overcome. The move towards more inclusive practices would benefit transition-aged individuals with disabilities to ensure they can fully participate in SE services and employment. Improved access to mainstream technologies within the VR system has provided job seekers with opportunities to acquire new skills in using mainstream devices and applications for accessing job training resources, virtual support, and engaging in job interviews with potential employers. Importantly, it has also played a pivotal role in improving tech literacy, empowering them to learn, navigate and utilize technology in pursuing employment opportunities. Moreover, it has enabled them to utilize applications on mainstream mobile devices to perform job tasks and enhance their autonomy in the workplace, and opened up various communication options, including taking advantage of built-in accessibility features based on their needs, and allowing them to choose the communication methods that best align with their personal preferences and abilities. However, they might need training and assessment to determine which mobile platform is most usable and accessible for their specific needs. Given the continued integration of virtual SE and embracing of more technologies in SE service provision, a crucial consideration is determining which training and best practices have been effective and should be upheld and improved upon in the post-pandemic era.

## **CHAPTER FOUR: COMPETITIVE INTEGRATED EMPLOYMENT OUTCOMES FOR TRANSITION-AGED YOUNG ADULTS WITH COGNITIVE DISABILITIES ACROSS PANDEMIC-RELATED PERIODS: ASSISTIVE TECHNOLOGY AND SUPPORTED EMPLOYMENT SERVICES**

### **Overview**

**Purpose:** Transition-aged young adults (TAYA) with cognitive disabilities often face challenges in finding and maintaining competitive integrated employment (CIE). Despite being the largest population of vocational rehabilitation (VR) service users, these individuals often experience poor employment outcomes at program exit. Prior research has explored the effects of the COVID-19 pandemic on VR service delivery and employment. However, limited research has assessed the impact of specific VR services, such as supported employment (SE) and assistive technology (AT) services, on achieving CIE outcomes and whether the likelihood of achieving CIE was impacted by the pandemic for TAYA with cognitive disabilities.

**Methods:** This study is a retrospective cross-sectional analysis of national data collected by the Rehabilitation Services Administration's Case Service Report, covering five program years from July 2017 to June 2022. The sample includes 238,561 cases of TAYA with primary diagnoses of cognitive disabilities who were deemed eligible for VR services. We used multivariable logistic regression to examine how the receipt of AT and/or SE services was independently associated with obtaining CIE at program exit. Interaction terms were included in the model to examine how the probabilities of achieving CIE varied over time (pre-COVID [Before March 11, 2020], during COVID [March 11, 2020, through July 8, 2021], and post-COVID [After July 8, 2021]) for those receiving AT and/or SE among TAYA with cognitive disabilities.

**Results:** Among TAYA with cognitive disabilities served by state VR programs in our study sample, 96.8% had significant disabilities, 90.9% were unemployed, and 83.0% were not enrolled in post-secondary education (PSE). Over half of participants (55.9%) did not achieve CIE at program exit. Only 1.4% received AT services, and 10.7% received SE services. Overall, AT and SE services were positively associated with achieving CIE. However, the effects of these services varied across the three COVID-19-related periods. Those receiving AT services were more likely to achieve CIE during and after the pandemic, whereas those receiving SE services were substantially more likely to achieve CIE across all three periods, particularly post-pandemic.

**Conclusion:** The study indicates that AT and SE services were positively associated with achieving CIE outcomes for TAYA with cognitive disabilities. These findings underscore the importance of prioritizing access to these services through state VR programs to better support employment transitions in the post-pandemic era.

## Introduction

Achieving employment is a critical milestone in the transition to adulthood, linked to financial independence, poverty alleviation, improved physical and mental health, overall well-being, and quality of life (McKee-Ryan et al., 2005; Okyere et al., 2021; Reichard et al., 2019; Schur, 2002; Shandra & Hogan, 2008). Employment provides a sense of purpose, belonging, and opportunities for social inclusion (Roux et al., 2019). It involves integrating into a social network, contributing to society, making choices and decisions, and being seen as part of the community (Chen et al., 2014). Research indicates that individuals with disabilities who participate in competitive integrated employment (CIE) benefit from enhanced economic, psychological, and physical health outcomes (Taylor et al., 2022). Specifically, those engaged in CIE earn higher wages (Blick et al., 2016; Butterworth et al., 2015), work more hours (Cimera, 2011), and have greater independence and self-determination (Schall et al., 2020; Shogren et al., 2015) compared to their peers in sheltered workshops or non-integrated inclusive work environments. State vocational rehabilitation (VR) programs are uniquely positioned to help young adults with disabilities bridge the gaps in their transition to adulthood and access to VR support they need to obtain and maintain meaningful work. State VR programs are a key source of public assistance for many young adults with disabilities who are unemployed, underemployed, or on the verge of losing their jobs. Individuals with disabilities that impede their employment may access the state's VR services to prepare for, secure, retain, advance in, or regain employment that is consistent with their individual strengths, priorities, concerns, abilities, capabilities, interests, and informed choice (RSA, 2019).

Employment rates for young adults with disabilities are significantly lower than those without disabilities. For ages 16-19, the employment rate is 17% compared to 31% without

disabilities, and for ages 20-24, it is 38% compared to 67% without disabilities (Bureau of Labor Statistics, 2020). While transition-aged young adults (TAYA) with disabilities aged 18-24 generally have lower employment rates than their peers without disabilities, those TAYA with cognitive disabilities have lower employment rates than those with other types of disabilities (Nord, 2020; Winsor et al., 2021; Chen et al., 2015; Kaya et al., 2021; Weld-Blundell et al., 2021; Newman et al., 2011), making them one of the most excluded groups from the labor force (Nord, 2020). According to the most recent Annual Disability Statistics Compendium (2023), 66.4% of those with cognitive disabilities were unemployed, and their employment rate was significantly lower compared to those with other types of disabilities. Similarly, the recent data from the American Community Survey (ACS) shows that TAYA with auditory disabilities had an employment rate of 40%, and those with visual disabilities had 36.3%. In contrast, TAYA with cognitive disabilities had the lowest employment rate at 30%, indicating that this group fares worse in employment compared to their peers with other types of disabilities (Erickson, Lee, & von Schrader, 2022). A follow-up of the National Longitudinal Transition Study (NLTS-2), one of a series of congressionally mandated studies sponsored by the U.S. Department of Education, documented that TAYA with disabilities, aged 18 to 24, are less likely to be employed or enrolled in post-secondary education (PSE) compared to their peers without disabilities, with cognitive disabilities accounting for the most common type of reported disability (69.5%) among this transition-aged population (Cheng & Shaewitz, 2019). Common themes in federal definitions of cognitive disability include difficulties in executive functioning, which refer to the higher-level cognitive skills used to coordinate other cognitive abilities and behaviors. These difficulties encompass learning, remembering, concentrating, processing information, filtering distractions, focusing attention, problem-solving, and decision-making

(Butterworth et al., 2014; RSA, 2019). Deficits in these areas can result in a slow work pace, high error rates, challenges in job task sequencing due to difficulties following instructions or completing multi-step projects, and issues with time management, planning, communication, and social functioning (Nord et al., 2013).

This population has expressed a strong desire to work, participate fully in the labor force, and expect to be employed after graduation (Barrows et al., 2015; Timmons et al., 2011; Winsor et al., 2021). Despite forming the largest population of VR service users, TAYA with cognitive disabilities often experience poor employment outcomes upon exiting state VR programs (Burgess & Cimera, 2014; Chen et al., 2015; Cimera & Cowan, 2009; Kaya, 2018; Lawer et al., 2009; Migliore et al., 2014; Winsor et al., 2021). The poor employment outcomes for TAYA with cognitive disabilities contribute to economic and social exclusion, underscoring the need for targeted policies and interventions to bridge this employment gap. Recent policy changes, such as the 2014 Workforce Innovation and Opportunity Act (WIOA), seek to increase access to and opportunities for the employment, education, training, and support services to individuals as they transition with skills needed to succeed in the labor market (Roux, Garfield, & Shattuck, 2019). WIOA strengthens the role of state VR programs in the transition process, increasing access to training, supports and services, and prioritizing CIE as an outcome to ensure greater opportunities for this transition-aged population (Pub. L. 113-128).

Research emphasizes the importance of education and early work experiences, noting that a person's prior training and employment can significantly influence opportunities for working in CIE settings. The significance of early work experience is evident among high school students with disabilities, particularly paid employment, in helping youth with cognitive disabilities attain CIE in adulthood and avoid negative outcomes (Carter et al., 2012; Siperstein et al., 2014;

Wehman et al., 2015). Studies have also shown that training and education received in PSE are positively associated with achieving CIE, and enrollment in PSE predicts successful CIE outcomes for TAYA with cognitive disabilities (Grigal et al., 2011; Kaya et al., 2018; Migliore et al., 2012; Moore & Schelling, 2015; Sung et al., 2015; Wehman et al., 2015). TAYA with cognitive disabilities who participate in PSE often work in CIE settings, work more hours, and earn higher wages (Cimera et al., 2018). However, research indicates that relatively few TAYA with cognitive disabilities transition to PSE, with the majority entering the workforce directly after completing secondary education (Burgess & Cimera, 2014; Shattuck et al., 2012).

When TAYA with cognitive disabilities are employed, their jobs often involve limited hours, low wages, and fewer employer-provided benefits compared to their peers without disabilities (Luhr et al., 2023; Winsor et al., 2021). Previous research has highlighted the significance of involving and collaborating with employers in the transition process (Oertle & Trach, 2007; Sabbatino & Macrine, 2007; Tilson et al., 1994). Additionally, a lack of sufficient knowledge among employers on how to support employees with disabilities can also influence an individual's transition process (Kim, 2022).

Despite valuing and striving to achieve employment success among this population, they often face challenges and require tailored VR interventions to prepare for, find, or retain jobs (Strauser, 2020). Research indicates that TAYA with cognitive disabilities can be successfully employed, when appropriately supported (Burgess & Cimera, 2014; McDonough & Revell, 2010). The transition process involves a coordinated set of support services designed to facilitate the movement of TAYA with cognitive disabilities from high school to adulthood, including employment, education, independent living, and community participation (Kaya et al., 2021). Wehman et al. (2014) concluded that among transition support services for TAYA with cognitive

disabilities, supported employment (SE) is particularly beneficial for successful employment outcomes at VR program exit. SE is a tailored VR intervention that aligns with the strengths, priorities, abilities, interests, and informed choices of individuals with disabilities. SE assists job seekers in obtaining or maintaining CIE by supporting them in job discovery and search, securing employment through job placement, identifying training needs for job skills, and performing job tasks at the worksite through job coaching (Schall et al., 2015).

Research has also shown that assistive technology (AT) services provided through state VR programs have the potential to improve CIE outcomes for TAYA with cognitive disabilities (Chen et al., 2015; Kaya et al., 2016). A growing body of literature supports the use of mainstream mobile devices and applications for young adults with cognitive disabilities to improve work task completion, teach job skills, promote independence in the workplace, enhance employment-related outcomes, and provide access to more employment opportunities (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013; Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Kuo et al., 2023; Lenker et al., 2013; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010). Mainstream technologies can be used to enable, improve, or extend cognitive and learning skills, as well as allow individuals with different cognitive abilities to perform tasks in the workplace more effectively (Zallio & Ohashi, 2022). Mobile applications offer video modeling and provide prompting systems via pictures, videos, audio, and text to accommodate different learning styles and cognitive abilities, particularly helping young adults with cognitive disabilities to perform job tasks more independently and with greater ease (Kuo et al., 2023). Moreover, mainstream mobile devices now include more built-in accessibility features targeting the needs of individuals with cognitive disabilities. Features like the Assistive Access feature allow users to customize their iPhones to reduce

cognitive load and suit their specific needs. Guided Access feature helps users stay focused on a single task or app, while Focus feature enables concentration by limiting distractions and activating specific focus areas on the iPhone (Cognitive accessibility, n.d.). Prior literature emphasizes the importance of enhancing digital literacy to support post-secondary employment transitions (Albright et al., 2023; Kaya et al., 2021). Technology can be tailored to meet the specific needs of TAYA with cognitive disabilities as they transition from school to employment (Burgstahler, 2003; Bryant et al., 2012; Luckasson & Schalock, 2012). However, TAYA with cognitive disabilities in state VR programs often have limited access to such AT support (Alshamrani et al., 2023; Chen et al., 2015; Huang et al., 2016).

Obtaining and maintaining CIE has been challenging for TAYA with cognitive disabilities, even before the coronavirus (COVID-19) pandemic. The pandemic may have exacerbated these challenges, making it even harder to find or maintain CIE due to fewer job opportunities and reduced support availability (Okyere et al., 2021). On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic (Cucinotta & Vanelli, 2020). The pandemic led to the highest unemployment rate in the United States since 1948, driven by mandatory shutdowns and voluntary business closures, which resulted in furloughed or laid-off employees and a limited number of available jobs in the labor market (Wong et al., 2022). The unemployment rate surged rapidly, surpassing the peaks of the Great Recession by April 2020, and labor force participation plummeted to its lowest level, particularly affecting many younger workers and those with lower educational attainment, who experienced higher unemployment rates and significant declines in labor force participation (Falk et al., 2021). Many individuals lost their jobs or had their working hours reduced (Sinclair et al., 2020). The pandemic not only impacted employment status but also disrupted the delivery of VR

services for clients. Many clients experienced a shift from in-person to virtual support, had their services cut back, or lost all their support during the pandemic (Hewitt et al., 2022).

With the rapid transition to virtual support during the pandemic, VR service providers had to quickly adapt and develop the technological competencies necessary to continue offering services (Hartley & Bourgeois, 2020). This transition was challenging, as less than 40% of VR service providers had ever provided virtual support or used technology-based supports before the pandemic; this figure rose to 98% during the pandemic (Hartley et al., 2023). Despite efforts by VR service providers to come up with new alternative methods to support clients with disabilities virtually and increased reliance on technology in the delivery of services, not all clients could access these services (Okere et al., 2021). Lack of internet access, digital literacy, unsupported access to devices/applications, and inadequate training on technology for clients and/or service providers hindered the effectiveness of VR services during the early stages of the pandemic (Dallas et al., 2022; Pogoda et al., 2021). Some state VR programs responded by implementing policies to improve access to AT services by purchasing mainstream mobile devices for some clients who participated in SE services (Anderson et al., 2021). For other SE clients who were funded by Medicaid Home and Community-Based Services (HCBS) faced barriers due to policy restrictions within the HCBS waiver system on funding for mainstream mobile devices and applications (Friedman, 2022).

Several studies have highlighted the potential for virtual support to become a new norm for SE service delivery, presenting a promising model for circumventing many of the barriers associated with in-person service delivery and its potential to increase service accessibility, inclusivity, and efficiency in better serving clients (Ahonle et al., 2021; Akemoglu et al., 2021; Hinton et al., 2023; Ottomanelli et al., 2021; Tassé et al., 2020). As pandemic restrictions waned,

it is expected that virtual supports will persist beyond the pandemic, as many SE service providers reported that they would continue to use virtual supports post-pandemic (Butterworth, 2021; Mahoehney et al., 2024; Timmons et al., 2022).

Previous studies have focused on the impacts of the COVID-19 pandemic on the delivery of VR services (Hartley & Bourgeois, 2020; Mahoehney et al., 2024; Hartley et al., 2023; Pogoda et al., 2021; Anderson et al., 2021). Other studies have demonstrated how the COVID-19 pandemic has negatively impacted employment status (Okyere et al., 2021; Sinclair et al., 2020; Schall et al., 2021; Wong et al., 2022). However, little research has assessed the impact of specific VR services, such as SE and AT services, on achieving CIE outcomes for TAYA with cognitive disabilities across three pandemic-related periods: pre-COVID, during COVID, and post-COVID. There has yet to be documentation of pandemic-related changes made to these VR services and the coinciding impact of these changes on obtaining CIE outcomes for TAYA with cognitive disabilities. Thus, the purpose of this study was to examine how the receipt of AT and/or SE services is associated with the probabilities of obtaining CIE outcomes at program exit and how these probabilities varied across the pre-COVID, during COVID, and post-COVID periods among TAYA with cognitive disabilities served by state VR programs.

## **Methods**

### **Sampling and Participants**

This was a retrospective cross-sectional study using the RSA-911 data, the federal database on VR clients who applied for and participated in VR services. This study included five program years from July 2017 to June 2022, with 2,211,191 cases exiting the VR program during that period. Of the cases that exited the program during that period, 804,999 cases were applicants, and 1,406,192 cases were deemed eligible for receiving VR services. Because this

study was focused on TAYA, only cases aged between 18 and 24 years were included (N=432,020). Among those TAYA, we included cases with a primary diagnosis of cognitive disabilities (code 17), which RSA defines as disabilities related to learning, thinking, processing information, and concentration (e.g., intellectual disability, autism spectrum disorder, learning disabilities, attention-deficit/hyperactivity disorder, and attention-deficit disorder). A total of 238,561 cases were included in the final sample for analyses. These cases met the criteria of being TAYA, had a primary diagnosis of cognitive disability, and were deemed eligible for receiving VR services.

### **Dependent and Independent Variables**

The dependent variable of interest was competitive integrated employment (CIE) at program exit. CIE, as defined in 34 CFR 361.5(c)(9), refers to *employment that is performed on a full-time or part-time basis for which an individual is paid the same wage by the employer for the same or similar work performed by other employees without disabilities, in a location typically found in the community where the employee with a disability interacts with others without disabilities as customers, vendors, and/or other employees* (RSA, 2019). In the RSA data, there are three exit data elements (i.e., exit type, exit reason, employment outcome at exit) that describe the employment outcome at case closure. For this study, CIE was recoded into a dichotomous categorical variable indicating whether the individual exited with CIE (1 = yes) or without CIE (0 = no). The ‘yes’ CIE outcome included RSA's CIE coded in exit type code (6), exit reason code (14), and employment outcome at exit code (1). The ‘no’ CIE outcome included those cases who exited without an employment outcome or non-competitive and/or non-integrated employment at program exit.

The independent variables for this study were two specific VR services and a time variable. AT service reflects the selection, acquisition, or use of devices (34 CFR 361.5(c)(6)). In these RSA data, AT services include the use of devices and/or assistance in evaluating needs, acquiring a device, and training on the device (RSA, 2019). All AT services provided and purchased by VR programs or provided by comparable benefits providers for VR clients were consolidated into two codes: received AT services (1=yes) versus did not receive AT services (0=no).

SE service, as defined in 34 CFR 361.5(c)(54), is an ongoing support service provided through state VR programs to support and maintain an individual with a disability in competitive integrated employment positions. SE, which may include customized employment, is tailored based on the individual's needs as outlined in their individualized plan for employment. Typically, SE services are provided to those with cognitive disabilities and are funded by state VR programs to support the transition from education to employment and are offered in a time-limited capacity, not exceeding four years or until the individual reaches the age of 25 years old, whichever comes first (34 CFR 361.5(c)(58)). All SE services provided and/or purchased by VR programs and offered by comparable benefits providers for VR clients were consolidated into two codes: received SE services (1=yes) versus did not receive SE services (0=no).

The third independent variable was a time variable reflecting three pandemic-related periods: pre-COVID [Before March 11, 2020], COVID [March 11, 2020, through July 8, 2021], and post-COVID [After July 8, 2021]. This categorization is based on the World Health Organization's declaration of COVID-19 as a pandemic on March 11, 2020 (Cucinotta & Vanelli, 2020; Fuentes & Lindsay, 2023), the government executive orders for Colorado's

declaration of a state of emergency in response to COVID-19 on the same date (D 2020-003), and the termination of the state of emergency on July 8, 2021 (D 2021-122).

Several sociodemographic variables were used as covariates, including (a) age at start of VR program; (b) sex (male/female); (c) race/ethnicity classified into two categories based on minority status: minority (American Indian or Alaska Native, Asian, African, Native Hawaiian or other Pacific Islander, Hispanic) versus non-minority (White non-Hispanic); (d) enrollment in PSE (yes/no); (e) significance of disability (yes/no: significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment); (f) employed at application (yes/no); (g) low-income status (yes/no), along with other VR services received (yes/no) such as pre-employment transition services (pre-ETS), training services, career services, and other services. Pre-ETS, as defined by RSA (2019), offer students with disabilities an early start in career exploration and preparation for adult life. These services, beginning at age 14, aim to enhance transition planning and support students in gaining the knowledge and experiences necessary for future careers. Training services are specifically designed to help individuals with disabilities improve educationally or adjust to the functional limitations of their impairments. Career services aim at providing career counseling and guidance, assistance with job searching, development of job interview skills, and the necessary support for individuals to maximize opportunities for employment and career advancement. Other services include assistance with monetary support (i.e., food, shelter, cost of job uniforms), transportation, and other services that cannot be recorded elsewhere, including provision of funds for occupational licenses, job-related equipment and tools, or initial stocks and supplies (RSA, 2019).

## Statistical Analysis

Descriptive statistics were computed for the sample and stratified by the two VR services of interest (AT and SE) to examine the frequencies and percentages of these two services received within the sociodemographic variables, other VR services, the three COVID-19-related periods, and CIE achieved at program exit. Chi-square and independent t-test bivariate analyses were performed to empirically examine differences in covariates, COVID periods, and CIE between the two VR services of interest. For inferential statistics, we used multiple logistic regression analysis to consider relationships between the independent variables and obtaining CIE at program exit (binary outcome). To determine if the relationships between the two VR services variables and CIE varied over time, we included interaction terms between each of the two VR services variables of interest and the COVID-19 period variable. Sociodemographic and other VR service variables were included in the model as covariates to adjust for potential confounders in the impact of receiving the two VR services of interest on CIE outcomes. All variables were included in the model simultaneously, with the sample's most normative group designating as the reference category for sociodemographic covariates, and non-recipients of services as the reference category. Model-adjusted probabilities of achieving CIE were calculated for both those who received and those who did not receive AT and/or SE services for each of the three COVID-19-related periods (pre-, during, and post-pandemic). The odds ratios are presented with 95% confidence intervals. All statistical analyses used a significance level of .05 and were performed using IBM SPSS Statistics for Windows (Version 29).

## Results

### Descriptive Statistics

Our sample included 238,561 TAYA with cognitive disabilities, ranging in age from 18 to 24 years old. The mean age was 19.4 years with a standard deviation (SD) of 1.73 years. A vast majority in the study sample had significant disabilities (96.8%) and were unemployed (90.9%). Males accounted for 62.2% of the total sample, and a substantial 83.0% were not enrolled in PSE in our sample. Most participants were white non-minorities (52.6%) and not classified as low income (56.5%). In terms of VR services utilization, 72.5% used career services, followed by other services (20.8%), training services (19.7%), and pre-ETS (15.8%). This distribution reveals a preference and need among sample participants for career services that aim at enhancing employment prospects. Nevertheless, a substantial proportion (55.9%) of the TAYA with cognitive disabilities did not achieve CIE outcomes at VR program exit.

Only 1.4% of the total sample received AT services. In contrast, 10.7% received SE services. Females had slightly higher AT use (1.5%), whereas males had slightly higher SE use (11.1%). TAYA with significant cognitive disabilities were less likely to receive AT services (1.4%) than those without significant cognitive disabilities (1.9%), but they were more likely to receive SE services (11.0% and 0.7%, respectively), indicating an emphasis on employment for those with significant cognitive disabilities and potentially broader access to AT services for those with no significant cognitive disabilities.

Regarding employment status, TAYA with cognitive disabilities who were employed were more likely to receive AT services (1.9%) than those who were unemployed (1.4%). In contrast, TAYA with cognitive disabilities who were employed were less likely to receive SE services than those who were unemployed (9.4% versus 10.8%), highlighting SE services' focus

on facilitating and/or obtaining employment for job seekers, whereas AT services are more likely to be accessible for employees with established employment. In terms of income status, TAYA with cognitive disabilities who were not classified as low income were slightly more likely to receive AT services (1.6%), compared to those classified as low income (1.3%), but they were less likely to receive SE services: 9.1% and 12.8%, respectively. This distribution suggests a focus on providing SE services to support those with financial challenges toward achieving employment, while AT services are slightly more likely to be accessed by those with higher income status.

TAYA with cognitive disabilities who did not enroll in PSE were less likely to receive AT services (1.3%) than those who enrolled (2.2%), but they were more likely to receive SE services (12.3% versus 3.0%). This highlights a focus in providing SE services more extensively to those not participated in PSE, aiming to enhance their employment prospects, while AT services are more available to those enrolling in PSE. Among AT recipients, training services were the most used (3.8%), indicating a focus on academic training and enhancing educational outcomes for those utilizing AT services. For SE recipients, other services were the most used (16.6%), suggesting a broad range of support needs among those pursuing services, such as transportation and assistance with monetary support to mitigate barriers toward pursuing employment.

In terms of the COVID-19 pandemic, prior to the pandemic, the receipt of AT services was at 1.7%, while the receipt of SE services was at 11.2%. During the pandemic, utilization slightly decreased to 1.1% for AT and 9.3% for SE. After the pandemic, the percentages remained similar to the pandemic period, with AT services at 1.1% and SE services at 10.8%.

Less than half of TAYA with cognitive disabilities (44.1%) achieved CIE at program exit. Both AT and SE service utilization were higher among those achieving CIE compared to those who did not: AT = 1.8% versus 1.2%; SE = 18.1% versus 4.8%. See Table 5 and Figure 9 for descriptive summaries.

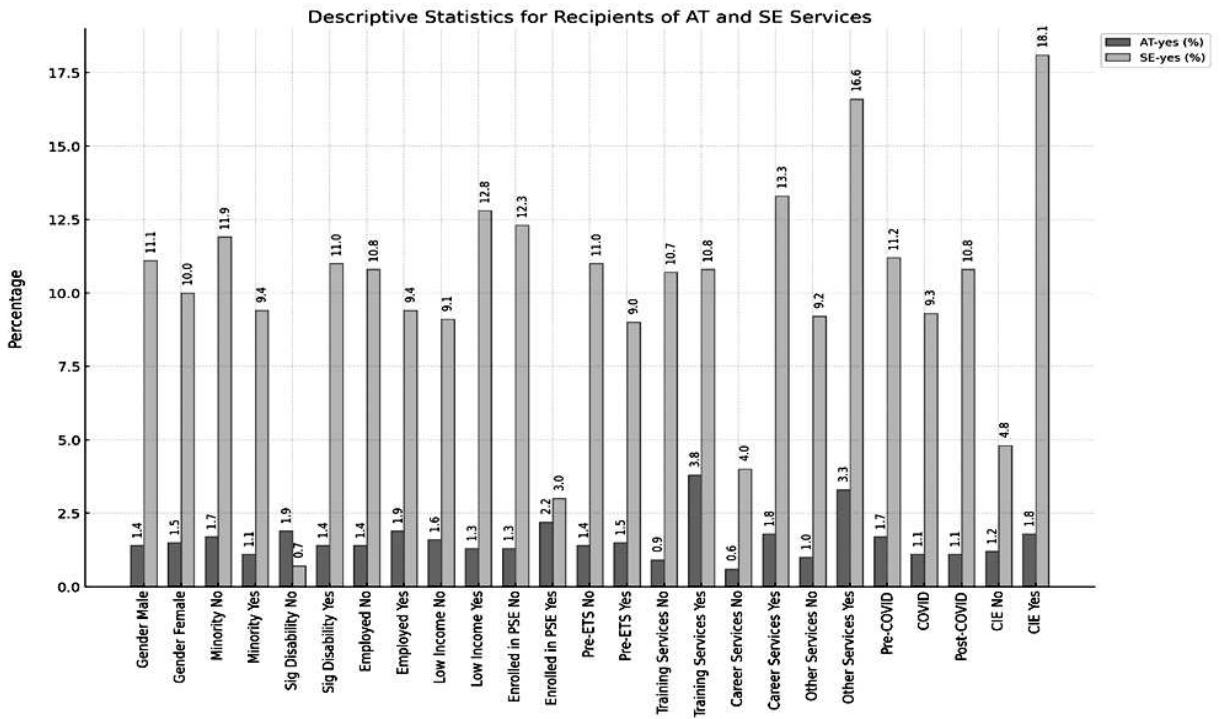
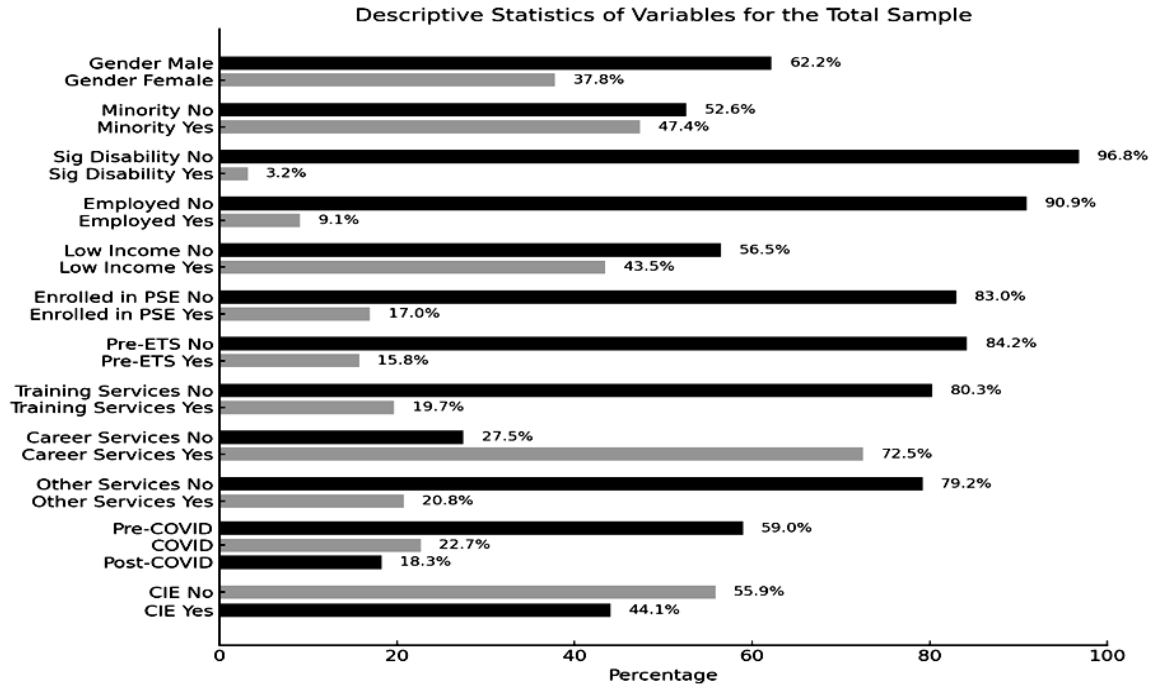
Table 5. Descriptive statistics.

Variable	Total n=238,561	Receipt of AT Services		p-values	Receipt of SE services		p-values
		AT-no n=235,103 (98.6%)	AT-yes n=3,458 (1.4%)		SE-no n=213,030 (89.3%)	SE-yes n=25,531 (10.7%)	
<b>Age</b> <sup>a</sup>				<.001			<.001
Mean (SD)	19.4 (1.73)	19.4 (1.73)	19.3 (1.69)		19.3 (1.67)	20.3 (1.90)	
<b>Sex</b> <sup>a</sup>				.017			<.001
Male	148,152 (62.2%)	146,071 (98.6%)	2,081 (1.4%)		131,674 (88.9%)	16,478 (11.1%)	
Female	90,028 (37.8%)	88,655 (98.5%)	1,373 (1.5%)		81,026 (90.0%)	9,002 (10.0%)	
<i>Missing= 381</i>							
<b>Minority</b> <sup>a</sup>				<.001			<.001
No	124,640 (52.6%)	122,461 (98.3%)	2,179 (1.7%)		109,808 (88.1%)	14,832 (11.9%)	
Yes	112,214 (47.4%)	110,944 (98.9%)	1,270 (1.1%)		101,676 (90.6%)	10,538 (9.4%)	
<i>Missing= 1,707</i>							
<b>Sig Disability</b> <sup>a</sup>				.001			<.001
No	7,750 (3.2%)	7,604 (98.1%)	146 (1.9%)		7,695 (99.3%)	55 (0.7%)	
Yes	230,805 (96.8%)	227,493 (98.6%)	3,312 (1.4%)		205,329 (89.0%)	25,476 (11.0%)	
<i>Missing= 6</i>							
<b>Employed</b> <sup>a</sup>				<.001			<.001
No	216,811 (90.9%)	213,761 (98.6%)	3,050 (1.4%)		193,323 (89.2%)	23,488 (10.8%)	
Yes	21,668 (9.1%)	21,260 (98.1%)	408 (1.9%)		19,625 (90.6%)	2,043 (9.4%)	
<i>Missing= 82</i>							
<b>Low Income</b> <sup>a</sup>				<.001			<.001
No	133,908 (56.5%)	131,788 (98.4%)	2,120 (1.6%)		121,675 (90.9%)	12,233 (9.1%)	
Yes	103,184 (43.5%)	101,867 (98.7%)	1,317 (1.3%)		90,022 (87.2%)	13,162 (12.8%)	
<i>Missing= 1,469</i>							
<b>Enrolled in PSE</b> <sup>a</sup>				<.001			<.001
No	197,883 (83.0%)	195,338 (98.7%)	2,545 (1.3%)		173,584 (87.7%)	24,299 (12.3%)	
Yes	40,598 (17.0%)	39,685 (97.8%)	913 (2.2%)		39,366 (97.0%)	1,232 (3.0%)	
<i>Missing=80</i>							
<b>Pre-ETS</b> <sup>a</sup>				.096			<.001
No	200,926 (84.2%)	198,049 (98.6%)	2,877 (1.4%)		178,767 (89.0%)	22,159 (11.0%)	
Yes	37,635 (15.8%)	37,054 (98.5%)	581 (1.5%)		34,263 (91.0%)	3,372 (9.0%)	

Table 5. (continued)

Variable	Total n=238,561	Receipt of AT Services		p-values	Receipt of SE services		p-values
		AT-no n=235,103 (98.6%)	AT-yes n=3,458 (1.4%)		SE-no n=213,030 (89.3%)	SE-yes n=25,531 (10.7%)	
<b>Training Services<sup>a</sup></b>				<.001			.300
No	191,665 (80.3%)	189,981 (99.1%)	1,684 (0.9%)		171,215 (89.3%)	20,450 (10.7%)	
Yes	46,896 (19.7%)	45,122 (96.2%)	1,774 (3.8%)		41,815 (89.2%)	5,081 (10.8%)	
<b>Career Services<sup>a</sup></b>				<.001			<.001
No	65,645 (27.5%)	65,279 (99.4%)	366 (0.6%)		63,029 (96.0%)	2,616 (4.0%)	
Yes	172,916 (72.5%)	169,824 (98.2%)	3,092 (1.8%)		150,001 (86.7%)	22,915 (13.3%)	
<b>Other Services<sup>a</sup></b>				<.001			<.001
No	188,945 (79.2%)	187,147 (99.0%)	1,798 (1.0%)		171,641 (90.8%)	17,304 (9.2%)	
Yes	49,616 (20.8%)	47,956 (96.7%)	1,660 (3.3%)		41,389 (83.4%)	8,227 (16.6%)	
<b>COVID</b>				<.001			<.001
Pre-COVID	140,830 (59.0%)	138,463 (98.3%)	2,367 (1.7%)		125,017 (88.8%)	15,813 (11.2%)	
COVID	54,188 (22.7%)	53,572 (98.9%)	616 (1.1%)		49,168 (90.7%)	5,020 (9.3%)	
Post-COVID	43,543 (18.3%)	43,068 (98.9%)	475 (1.1%)		38,845 (89.2%)	4,698 (10.8%)	
<b>CIE</b>				<.001			<.001
No	133,283 (55.9%)	131,698 (98.8%)	1,585 (1.2%)		126,825 (95.2%)	6,458 (4.8%)	
Yes	105,278 (44.1%)	103,405 (98.2%)	1,873 (1.8%)		86,205 (81.9%)	19,073 (18.1%)	

Note. <sup>a</sup> Sociodemographic variables and other VR services variables were included as covariates in the subsequent logistic regression analysis. P-values were obtained from independent t-test for age and Chi-square tests for all other variables.



**Figure 9.** Descriptive cluster bar graphs of variables for the total sample and recipients of AT and SE services.

## Logistic Regression Analysis

The omnibus test for the multiple logistic regression model was statistically significant and explained 13.6% of the variance:  $X^2(19) = 24178.5, p < .001$ , Nagelkerke's  $R^2 = .136$ . The results of the multiple logistic regression analysis (regression coefficients, standard errors, Wald statistics, p-values, odds ratios, and 95% confidence intervals) are shown in Table 6.

Table 6. The logistic regression results for the main and interaction effects on achieving CIE outcomes.

Variables	$\beta$	SE	Wald	df	Sig.	Exp( $\beta$ )	95% CI	
							Lower	Upper
Constant	-1.532	0.054	819.717	1	<.001	0.216		
Age	0.029	0.003	114.071	1	<.001	1.029	1.024	1.035
Female (ref: male)	-0.165	0.009	332.287	1	<.001	0.848	0.833	0.863
Minority (ref: white non-minority)	-0.205	0.009	533.709	1	<.001	0.815	0.801	0.829
Enrolled in PSE (ref: not enrolled)	0.250	0.012	429.585	1	<.001	1.284	1.254	1.314
Not significant disability (ref: significant)	0.510	0.024	433.935	1	<.001	1.666	1.588	1.748
Employed (ref: unemployed)	0.630	0.015	1700.886	1	<.001	1.878	1.823	1.935
Low income (ref: not low income)	-0.216	0.009	573.095	1	<.001	0.806	0.791	0.820
Received pre-ETS (ref: not received)	-0.182	0.012	215.431	1	<.001	0.833	0.813	0.854
Received training service (ref: not received)	0.204	0.011	318.164	1	<.001	1.227	1.199	1.255
Received career services (ref: not received)	0.706	0.011	4466.870	1	<.001	2.026	1.985	2.069
Received other services (ref: not received)	0.393	0.011	1215.392	1	<.001	1.481	1.448	1.514
<b>Pandemic</b> (ref: COVID period)			337.176	2	<.001			
Pre-COVID	0.194	0.012	282.783	1	<.001	1.214	1.187	1.242
Post-COVID	0.045	0.015	9.503	1	.002	1.046	1.017	1.077
Received AT services (ref: not received)	0.189	0.086	4.832	1	.028	1.208	1.021	1.430
Received SE services (ref: not received)	1.393	0.034	1662.766	1	<.001	4.029	3.768	4.308
<b>Pandemic * Receipt of AT services</b>			10.995	2	.004			
Pre-COVID by Received AT services	-0.300	0.096	9.674	1	.002	0.741	0.613	0.895
Post-COVID by Received AT services	-0.112	0.134	0.706	1	.401	0.894	0.688	1.162
<b>Pandemic * Receipt of SE services</b>			88.299	2	<.001			
Pre-COVID by Received SE services	-0.136	0.039	12.091	1	.001	0.873	0.808	0.942
Post-COVID by Received SE services	0.260	0.051	26.035	1	<.001	1.296	1.173	1.432

Note.  $\beta$  = Regression coefficients; SE= Standard error; Wald= Wald statistics; df= degrees of freedom; Exp( $\beta$ ) = Odds ratio; CI = Confidence interval; PSE= Post-Secondary Education; pre-ETS= pre-employment transition services; ref= reference category.

## Main Effects

TAYA with cognitive disabilities who received AT services exhibited a 20.8% increase in the odds of achieving CIE ( $\beta = 0.189$ ,  $\text{Exp}(\beta) = 1.208$ ,  $p = .028$ ), compared to those who did not receive AT services, after adjusting for other covariates in the model. TAYA with cognitive disabilities who received SE services were also more likely to achieve CIE in comparison to those who did not receive SE services ( $\beta = 1.393$ ,  $\text{Exp}(\beta) = 4.029$ ,  $p < .001$ ), translating to a 4-fold increase in the odds of achieving CIE, after adjusting for other covariates in the model.

There was sufficient evidence to suggest that the odds of achieving CIE varied across the three COVID-19-related periods ( $\chi^2(2) = 337.176$ ,  $p < .001$ ). Using the COVID pandemic as the reference period, there was a 21.4% increase in the odds of achieving CIE ( $\beta = 0.194$ ,  $\text{Exp}(\beta) = 1.214$ ,  $p < .001$ ) pre-COVID compared to COVID period, and a modest 4.6% increase in the odds of achieving CIE ( $\beta = 0.045$ ,  $\text{Exp}(\beta) = 1.046$ ,  $p = .002$ ) post-COVID compared to COVID period, pointing to a gradual recovery phase following the significant disruptions on employment caused by COVID-19.

## Interaction Effects

The interaction term of the pandemic period by the receipt of AT services on achieving CIE was statistically significant ( $\chi^2(2) = 10.995$ ,  $p = .004$ ). Using the COVID pandemic as the reference period, the pre-COVID period by received AT services interaction term demonstrated a 26.9% decrease in the odds of achieving CIE compared to COVID period and those who did not receive AT services ( $\beta = -0.300$ ,  $\text{Exp}(\beta) = 0.741$ ,  $p = .002$ ). This suggests potential pre-pandemic limitations in accessing and/or effectively utilizing AT services for improving CIE among this population of TAYA with cognitive disabilities. In post-COVID period, compared to COVID period and those who did not receive AT services, there was not sufficient evidence to suggest a

difference in the odds of achieving CIE for those who received AT services ( $p = .401$ ), indicating that the impact of AT services, while improved during the pandemic, remained consistent into the post-COVID period. The interaction term of the pandemic period by the receipt of SE services on achieving CIE was statistically significant ( $\chi^2(2) = 88.299, p < .001$ ). Similarly, TAYA with cognitive disabilities who received SE services prior to the pandemic experienced a 12.7% decrease in the odds of achieving CIE compared to COVID period and those who did not receive SE services ( $\beta = -0.136, \text{Exp}(\beta) = 0.873, p = .001$ ). Conversely, the post-COVID by received SE services interaction term demonstrated a 29.6% increase in the odds of achieving CIE compared to COVID period and those who did not receive SE services, indicating enhanced benefits of SE services in facilitating CIE outcomes for TAYA with cognitive disabilities in the post-COVID period.

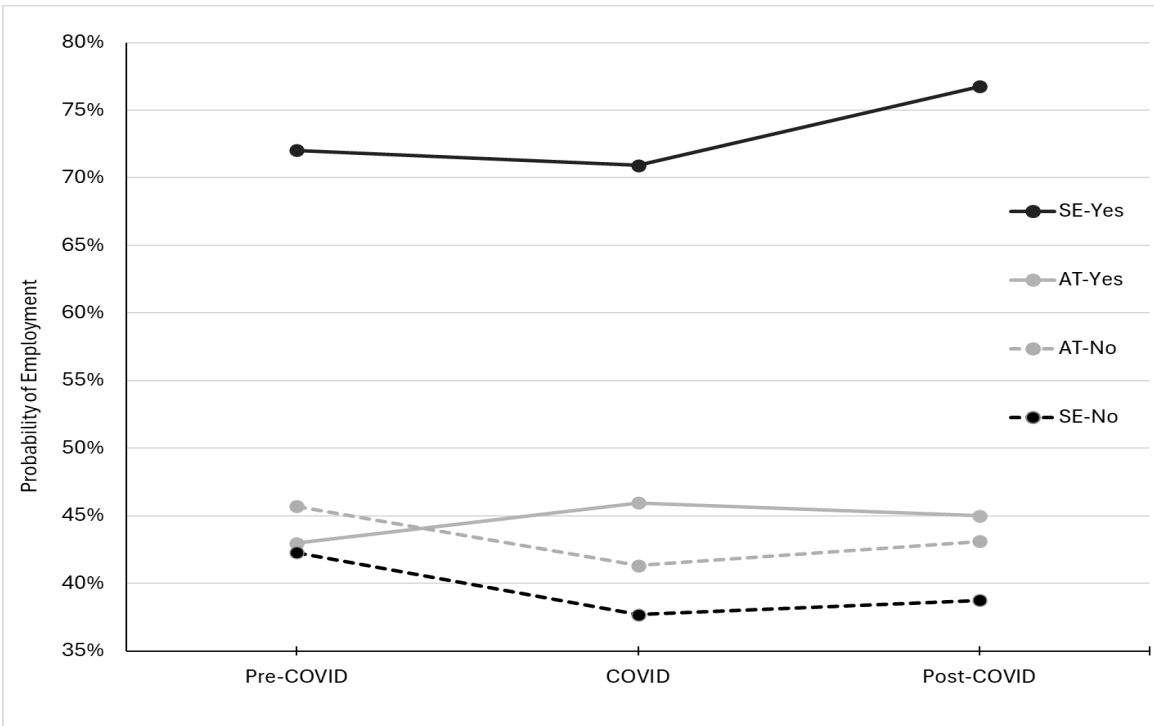
### **Covariates**

Regarding the covariates, being female was associated with a 15.2% decrease in the odds of achieving CIE compared to males ( $\beta = -0.165, \text{Exp}(\beta) = 0.848, p < .001$ ), and being a minority was associated with an 18.5% decrease in the odds of achieving CIE compared to being white non-minority ( $\beta = -0.205, \text{Exp}(\beta) = 0.815, p < .001$ ). Low-income TAYA with cognitive disabilities had 19.4% lower odds of achieving CIE than those who were not classified as low-income ( $\beta = -0.216, \text{Exp}(\beta) = 0.806, p < .001$ ). Conversely, being enrolled in PSE was associated with a 28.4% increase in the odds of achieving CIE compared to those who were not enrolled in PSE ( $\beta = 0.250, \text{Exp}(\beta) = 1.284, p < .001$ ), having no significant disability was associated with a 66.6% increase in the odds of achieving CIE compared to those with significant disabilities ( $\beta = 0.510, \text{Exp}(\beta) = 1.666, p < .001$ ), and employed TAYA with cognitive disabilities experienced 87.8% higher odds of achieving CIE than those who were unemployed ( $\beta = 0.630, \text{Exp}(\beta) =$

1.878,  $p < .001$ ). For each one-year increase in age at the start of VR services, there was a 2.9% increase in the odds of achieving CIE ( $\beta = 0.029$ ,  $\text{Exp}(\beta) = 1.029$ ,  $p < .001$ ). In terms of the receipt of VR services, career services significantly increased the odds of achieving CIE by 102.6% ( $\beta = 0.706$ ,  $\text{Exp}(\beta) = 2.026$ ,  $p < .001$ ), followed by other VR services with a 48.1% increase ( $\beta = 0.393$ ,  $\text{Exp}(\beta) = 1.481$ ,  $p < .001$ ) compared to those who did not receive these services. These two types of VR services are directly dedicated to assisting those with barriers to pursuing employment, maximizing their opportunities for achieving employment or career advancement. Training services also played a significant role, with a 22.7% increase in the odds of achieving CIE compared to those who did not receive these services ( $\beta = .204$ ,  $\text{Exp}(\beta) = 1.227$ ,  $p < .001$ ). In contrast, receipt of pre-ETS was associated with a 16.7% decrease in the odds of achieving CIE compared to those who did not receive pre-ETS ( $\beta = -0.182$ ,  $\text{Exp}(\beta) = 0.833$ ,  $p < .001$ ), as these services are designed to offer students early career exploration and preparation for future employment rather than obtaining employment.

### **Model-adjusted Probabilities of Achieving CIE**

Figure 10 shows the model-adjusted probabilities over the three COVID periods by AT and SE service utilization. Probabilities for TAYA with cognitive disabilities achieving CIE with no AT services ranged from 46% to 41% to 43% from pre-COVID to COVID to post-COVID periods. The probabilities for TAYA with cognitive disabilities receiving AT services achieving CIE ranged from 43% to 46% to 45%. The differences based on SE service utilization were much more profound with those not receiving SE achieving CIE at 42%, 38%, and 39% across pre-COVID, COVID, and post-COVID periods, respectively, and those receiving SE services achieving CIE at 72%, 71%, and 77%, respectively.



**Figure 10.** Model-adjusted probabilities of achieving CIE across three COVID-19-related periods.

### Discussion

The purpose of this study was to examine the extent to which the receipt of AT and/or SE services are associated with the probability of obtaining CIE outcomes at program exit for TAYA with cognitive disabilities participating in state VR programs and whether the likelihood of achieving CIE varied over time. A notable finding of this study was that more than half of TAYA with cognitive disabilities did not achieve CIE at program exit during our 5-year study period. Consistent with previous research (Burgess & Cimera, 2014; Chen et al., 2015; Cimera & Cowan, 2009; Kaya, 2018; Lawer et al., 2009; Migliore et al., 2014), these findings highlight the challenges faced by TAYA with cognitive disabilities in obtaining CIE. Most participants were not enrolled in PSE. Previous research indicates that upon exiting secondary education, only a small portion of TAYA with cognitive disabilities transition to PSE, while a larger portion seeks

employment and enters the workforce (Burgess & Cimera, 2014; Shattuck et al., 2012). Our findings show that those enrolled in PSE were more likely to achieve CIE at program exit compared to those who were not enrolled. This outcome may be further supported by the career services provided by colleges and universities, which complement the resources offered by state VR programs. These additional services potentially enhance the employment readiness and opportunities available to PSE students, contributing to their higher success rates in achieving CIE. This aligns with a previous study by Miller et al. (2019), which found that individuals with cognitive disabilities served by VR programs who participated in a PSE certificate or college degree program had better employment outcomes compared to their counterparts without any PSE. Research has shown that training and education received in PSE are positively associated with achieving CIE, and enrollment in PSE predicts successful CIE outcomes for TAYA with cognitive disabilities (Grigal et al., 2011; Kaya et al., 2018; Migliore et al., 2012; Moore & Schelling, 2015; Sung et al., 2015; Wehman et al., 2015).

Overall, our findings indicated that receiving AT and SE services was significantly and positively associated with achieving CIE outcomes at program exit for TAYA with cognitive disabilities, after adjusting for all other covariates. This result supports previous research, which indicates that TAYA with cognitive disabilities who received AT and/or SE services were more likely to achieve CIE than their peers who did not receive these services (Kaya et al., 2016; Sprong et al., 2019; Wehman et al., 2014). However, it is important to note that the provision of AT services was very limited in supporting this population in achieving CIE, with only 1.4% of the total sample receiving AT services. This aligns with prior research, which also found very small numbers of VR clients with cognitive disabilities receiving AT services (Chen et al., 2015; Huang et al., 2016). Moreover, the findings show that TAYA with significant cognitive

disabilities were less likely to receive AT services and achieve CIE outcomes compared to those without significant disabilities. However, they were more likely to receive SE services, indicating a focus on employment for individuals with significant disabilities and potentially broader access to AT services for those without significant disabilities. Workers with significant disabilities reported that technology was essential for increasing their opportunities to successfully work in the community (National Council on Disability, 2020). The availability of customized employment strategies in SE may make it possible for more individuals with significant disabilities to secure and maintain CIE (Luhr et al., 2023). Significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment. An individual with a significant disability is an individual who has a severe disability that impacts their ability to obtain or maintain employment. Such individuals typically have complex needs and require more VR services than those with a non-significant disability. Perhaps the combination of customized employment in SE and AT services could assist more individuals with significant disabilities to secure and maintain CIE. Increasing awareness and training for VR personnel regarding AT supports aimed explicitly at supporting those with significant disabilities to achieve better outcomes.

We observed a decline in achieving CIE, as well as a decrease in the overall utilization of AT and SE services during the pandemic period. Given the limited employment options in the job market due to the COVID-19 pandemic, VR clients may have been reluctant to seek employment or continue participating in their VR services. Some clients may have chosen to pause their participation in VR services due to the limited job options available or to leave the workforce during the pandemic due to health concerns or vulnerability to severe illness from COVID-19 (Rosencrans et al., 2021). Those who became unemployed or left the workforce

during the pandemic may have experienced difficulties in maintaining employment, as they were more likely to work in industries that experienced mass layoffs and furloughs, such as retail, entertainment, and food services (Schall et al., 2021). Additionally, they may have had limited access to needed services due to COVID-19 restrictions on social contact (Bradley, 2020; Gayle et al., 2021).

When examining the impact of receiving AT services on achieving CIE outcomes at program exit, our findings indicate that clients who received AT services during the pandemic period were more likely to achieve successful CIE outcomes compared to their peers who did not. Several factors could explain these differences. The pandemic restricted traditional services and necessitated a transition to remote support service delivery for many VR clients. Receiving AT services could enable these clients to better adapt to the changes in support and work environments by accessing mainstream mobile devices and applications needed to engage in virtual job meetings with potential employers, maintain continuity of support services and communication with their employment support professionals, and using applications that support an individual in performance of their job tasks independently without the need for the presence of employment support professionals at worksite (Gaspar et al., 2020). This could increase their chances of being employed or retained in CIE during the pandemic compared to those who did not have access to AT services at that time.

Several studies collectively highlight the role of technology use and access during COVID-19 in enabling individuals to receive real-time assistance and job coaching support, reducing the need for physical presence (Wagner et al., 2022). Additionally, these technologies provided opportunities for individuals to build important technology-related skills that are vital to much of the modern workforce and have historically been under-emphasized for many

individuals with cognitive disabilities (Mahoehey et al., 2024). The intersection of AT, particularly mainstream mobile devices and apps, with SE service support showcases the potential of blending these approaches to enhance employment outcomes for this population. The use of smart phones or tablets has shown potential to support individuals with cognitive disabilities working in CIE (Muharib et al., 2022). Smart phones and tablets can provide job coaching and task reminders to support people with cognitive disabilities to perform their job tasks as well as improve vocational skills in a variety of ways, for example by delivering text, audio, or pictorial cues; video modeling; and video prompting. Smart phones and other mainstream mobile devices are easier to use on the job and seen as more socially acceptable than having a job coach offer prompts as the individual is working, but training on how to use the technology is needed rather than simply implementing the technology on its own (Luhr et al., 2023). Studies predating the pandemic have examined the effectiveness of using mainstream mobile devices as VR interventions to improve employment outcomes. The results support their use in enhancing vocational skills, performing work-related tasks, increasing independence, and accessing employment opportunities for young adults with cognitive disabilities (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013; Collins & Collet-Klingenberg, 2018; Damianidou et al., 2019; Morash-Macneil et al., 2018; Randall et al., 2020; Sauer et al., 2010). Despite evidence supporting the use of technology for improving employment outcomes, many VR personnel reported pre-COVID challenges in preparedness and competencies to implement such interventions (Arthanat et al., 2017; Barzegarian & Sax, 2011; Estrada-Hernandez et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006; Riemer-Reiss, 2003). This professional readiness gap, coupled with policy funding restrictions, could hinder the effective use of AT services through state VR programs to improve CIE outcomes for TAYA

with cognitive disabilities pre-COVID. Our results indicate that TAYA with cognitive disabilities who accessed AT services achieved better CIE outcomes during COVID compared to pre-COVID, and this pattern remained stable post-COVID. Future research could include additional program years following the pandemic to fully capture the impact of AT services post-COVID on achieving CIE outcome at program exit. Non-AT recipients' CIE declined during the pandemic, with a slight recovery post-COVID, but not higher than pre-COVID period. This finding indicates that AT supports and services play an important role in assisting TAYA with cognitive disabilities in achieving successful CIE outcomes. It highlights the need for continued training and access to AT supports and services to facilitate successful employment outcomes for this population beyond the pandemic.

Our findings indicate that the utilization of SE services significantly increased the likelihood of achieving CIE across all time points, but particularly in the post-COVID period. This improvement can be attributed to the recovery phase as the pandemic receded and job opportunities increased, following the significant disruptions in employment experienced by many clients seeking or maintaining CIE during the pandemic. The overall benefit could be attributed to SE service providers' ability to consistently support their clients remotely during and after the pandemic, allowing for the continued delivery of all phases of SE with minimal in-person contact (Drake et al., 2021). The probabilities of achieving CIE across three COVID-19-related periods highlight an improvement for SE recipients in the post-COVID period compared to pre-COVID. This improvement in CIE can be credited with adaptations and innovations introduced to SE services during the pandemic, including the use of mainstream mobile devices and applications, as well as virtual support services. These innovations may introduce new approaches for effectively supporting clients, making SE services more inclusive of diverse

needs, more accessible to clients, and more efficient in helping job seekers find and maintain CIE compared to the pre-COVID period. The stark contrast in CIE probabilities between SE recipients and non-recipients, underscores the effectiveness of SE services in facilitating CIE for TAYA with cognitive disabilities.

## **Implications**

The literature demonstrates that AT and SE have the potential to help unemployed TAYA with cognitive disabilities work in CIE. The positive impact of these services highlights the necessity for state VR programs to become aware of and prioritize access to AT and SE services to support employment transition and bridge the employment gap for this population. The COVID-19 pandemic has underscored the need for state VR programs to adopt innovative approaches to better assist job seekers. Continued innovation in this area can help reach underserved young job seekers in rural communities and provide more inclusive support that accommodate individual needs, performances, and circumstances. Additionally, the expanded use of mainstream mobile devices and applications in SE practice can better support job seekers in achieving CIE. These innovations in the field of SE may improve pre-existing methods used before the pandemic, providing better support for clients striving to achieve CIE. The rapid development and availability of technological solutions to improve employment outcomes have historically been under-utilized, particularly for supporting TAYA with cognitive disabilities, and more specifically for those with significant disabilities. In this study, males, White clients, and those enrolled in PSE demonstrated higher success rates in CIE. State VR programs should ensure that women, people of color, those living in poverty, individuals with significant disabilities, unemployed individuals, and those with lower education levels have access to the

same effective services provided to individuals with more advantaged demographic characteristics.

The 2014 WIOA is designed to help job seekers access the employment, education, and training services they need to prepare them for CIE. Mainstream mobile devices and applications play a role in enhancing digital literacy for many job seekers with cognitive disabilities, equipping them with the skills needed to secure and maintain employment in competitive integrated settings. By improving digital literacy, technology not only empowers young adults with cognitive disabilities to compete in today's job market but also fosters greater independence and productivity. In the modern labor market, technology is essential for job skill learning, accessing employment opportunities, performing job tasks, and teaching vocational skills to people with cognitive disabilities. The use of technology has the potential to enhance employees' productivity, better meeting employers' needs while reducing the need for SE professionals to provide on-site job coaching, thereby increasing the independence of employees in the workplace. Moreover, as mainstream devices become more universally designed with built-in features such as Siri, TTS and STT, among other features that are essentially AT, the need for specialized AT devices decreases. For instance, the Assistive Access feature on iPhones allows users to customize their devices to reduce cognitive load and tailor functionality to their specific needs. Additionally, the Guided Access feature helps users stay focused on a single task or app, while the Focus feature enhances concentration by limiting distractions and activating specific focus areas on the iPhone (Cognitive accessibility, n.d.). These examples of built-in features could be used to meet the needs of individuals with cognitive disabilities receiving SE supports and reduce the stigma associated with using specialized AT devices on the job site.

The use of technology for employment-related purposes is promising, but it is underutilized by many TAYA with cognitive disabilities. Despite the potential benefits, coverage of mainstream mobile devices and applications that support job-seeking and employment for TAYA with cognitive disabilities remains limited. Furthermore, it is recommended for state VR programs and SE agencies to facilitate training opportunities. This is particularly important when service providers lack the competencies, knowledge, and skills to effectively utilize technology in assisting their clients who need and could benefit from such support. AT support should be offered in a client-centered manner, starting with a thorough evaluation process to address individual needs, followed by involving the client in the AT selection process and training, is essential for the successful adoption of technologies. Such AT support should not only assist job seekers to acquire devices or applications but also ensure that the selected technologies fit and meet their needs, as well as provide adequate training on how to use these selected technologies, not just for addressing cognitive limitations but as enabling tools that support job-seeking, employment access, and facilitate CIE.

### **Study Limitations**

There are several limitations to our study. First, data used for this study were designed for administrative purposes rather than research, leading to a lack of detailed information. One possible suggestion is to use a mixed-methods approach, which involves combining the secondary analysis of the RSA-911 data with qualitative data. This approach complements the quantitative data and enriches the insights gained from the secondary analysis. Second, as a retrospective observational study, it is subject to confounding by unobserved variables, meaning the findings cannot be used to infer causality. However, this study did identify significant statistical relationships between SE and AT services on achieving CIE outcomes at program exit

from pre-COVID to post-COVID. Third, the RSA-911 data have no information on the types of AT supports and services provided, such as selection, acquisition, and training, or the specific types of devices and/or applications used/accessed. Consequently, it was not possible to examine how different types of services, devices, or applications might impact CIE outcomes at exit. Fourth, the RSA-911 data do not include identifiable codes for whether SE services were provided in-person or virtually. Having access to more detailed data regarding the prescription of services and type of service delivery would be useful to allow program administrators and researchers to more thoroughly examine the impact of services provided on employment outcomes. Lastly, the data used in this study were collected from various state VR programs at a national level and were recorded by many VR counselors, raising the possibility of data input errors.

### **Conclusion**

TAYA with cognitive disabilities often experience barriers to achieving CIE upon exiting the program, despite being the largest and continually growing segment of state VR service users. Our findings indicated that TAYA with cognitive disabilities who received AT and SE had higher CIE success at exit than other clients who did not. These results underscore the importance of prioritizing and incorporating SE and AT services into employment transition processes to improve CIE outcomes for TAYA with cognitive disabilities. The COVID-19 pandemic negatively impacted employment outcomes and service utilization, with a notable decline in CIE rates and service utilization during this period. Nevertheless, TAYA with cognitive disabilities who received SE and AT services during the pandemic were able to alleviate some of the difficulties caused by the pandemic, continued receiving their remote support, and had better CIE outcomes. Innovative approaches prompted by the pandemic, the use

of virtual support, coupled with the expanding use of mainstream mobile devices and applications may offer better ways to support job seekers in achieving CIE. The intersection of AT and SE offers an opportunity to enhance CIE outcomes by integrating AT support with tailored SE support services. Access to AT supports and services for facilitating employment is promising, yet their utilization remains limited and under-emphasized, hindering their potential to support the employment transition for this population. The results showed that the probabilities of achieving CIE were higher among those receiving SE and AT services post-COVID compared to pre-COVID. This suggests the need for continued improvement efforts in targeted transition policies, practices to enhance the services and supports for TAYA with cognitive disabilities, and service provider trainings regarding potential AT benefits for this population. Such efforts are essential to bridge the employment gap and ensure that job seekers with cognitive disabilities have equitable opportunities and support they need for employment success.

## **CHAPTER FIVE: CONCLUSION**

The purpose of this dissertation was to investigate the barriers and facilitators affecting equitable access to AT, the AT utilization in SE, and the resulting CIE outcomes of TAYA with cognitive disabilities upon exiting state VR programs. The aim was to gain a thorough understanding of the underlying mechanisms for optimizing CIE success and bridging the employment gap among TAYA with cognitive disabilities. This dissertation included three studies—one qualitative and two quantitative—spanning the period from 2017 to 2022. Together, these studies provide implications and recommendations for policymakers and VR personnel to ensure that TAYA with cognitive disabilities receive the necessary access and support to obtain meaningful CIE. The findings from the three studies are mutually reinforcing, highlighting existing gaps, and offer future research directions, with each study resulting in a manuscript intended for submission to VR journals.

### **Findings Throughout the Three Dissertation Studies**

#### **Access to Assistive Technology Support**

The findings from this dissertation highlight several barriers to accessing AT supports and services for TAYA with cognitive disabilities in state VR programs. Despite many studies demonstrating that the provision of AT services in state VR programs positively predicts successful employment outcomes at program exit (Ahonle et al., 2020; Chiu et al., 2015; Duncan et al., 2020; Huang et al., 2013; Kaya et al., 2016; Sprong et al., 2019), these supports and services remains underutilized (Alshamrani et al., 2023; Chen et al., 2015; Huang et al., 2016). Study One revealed that TAYA with cognitive disabilities, the largest disability group within state VR programs, received limited access to AT supports and services, a finding consistent

with prior research (Chen et al., 2015; Huang et al., 2016; Sprong et al., 2019). Only a small percentage (2.9%) of TAYA with disabilities accessed AT supports and services, and Study Three further highlighted that a mere 1.4% of TAYA with cognitive disabilities accessed AT supports and services. This disparity is particularly concerning given the potential role of AT in facilitating the transition into CIE for this population. The low percentage of TAYA with cognitive disabilities accessed AT supports and services may be partly attributed to persistent gap in training, competencies, and preparedness among VR personnel, a concern that has been consistently noted over the past three decades (Arthanat et al., 2017; Barzegarian & Sax, 2011; Estrada-Hernandez et al., 2007; Froehlich & Linkowski, 2002; Kuo & Kosciulek, 2021; Noll et al., 2006; Riemer-Reiss, 2003; Szymanski et al., 1993). In Study Two, participants expressed a clear need for AT training for VR service providers to better support their clients, aligning with recent research emphasizing the importance of such training (Anderson et al., 2021; Dallas et al., 2022; Heman et al., 2022; Pogoda et al., 2021). The lack of adequately trained VR personnel likely limits both access to and the effectiveness of AT supports and services for clients. Study Two also revealed that the COVID-19 pandemic increased access to mainstream mobile devices and applications for job seekers with cognitive disabilities. However, critical aspects of AT—such as conducting AT evaluations, involving clients in the selection process, and providing adequate training—were often overlooked (Dallas et al., 2022). Many service providers were also compelled to offer VR support during the pandemic without prior training on how to use technology effectively to assist their clients (Anderson et al., 2021; Dallas et al., 2022; Heman et al., 2022; Hinton et al., 2023; Pogoda et al., 2021). Furthermore, service providers lacked training in ensuring that the technology used and the support provided to this population were designed with accessibility in mind (Levine et al., 2022). Enhancing AT training would not only

improve the competence of VR personnel in conducting effective AT evaluations, assisting clients in selecting appropriate AT, and providing training in its proper use, but would also increase awareness of the potential benefits of AT in supporting the transitions for TAYA, particularly those with cognitive disabilities. This, in turn, would promote more equitable access to AT in state VR programs that could be used to support job-seeking, employment access, and facilitate CIE. Thus, VR agencies should prioritize and facilitate training opportunities for their personnel, especially for those who lack the competencies, knowledge, and skills necessary to conduct AT evaluations or effectively use AT to support their clients' employment transitions.

Access to AT can be the difference between not being able to work and having the enabling tools needed for successful employment transitions. Our findings in Studies One and Three revealed that TAYA with disabilities who were neither enrolled in PSE nor employed at the time of application were less likely to access AT supports and services than those enrolled in PSE and employed. This observed increase in the use of AT among those enrolled in PSE and employed could be influenced by legislative requirements. Title I of ADA mandates AT accommodations in employment settings as appropriate, while Title II of ADA and Section 504 mandate such accommodations for students in PSE settings. However, a considerable proportion of this population is neither enrolled in PSE nor employed (Cheng & Shaewitz, 2019; Palmer et al., 2021). Previous research indicates that a small portion of TAYA with cognitive disabilities transition to PSE after completing K-12 education, while a larger portion seeks employment (Burgess & Cimera, 2014; Shattuck et al., 2012). Studies One and Three also highlighted that the majority of this population was neither enrolled in PSE nor employed seeking state VR programs assistance were underserved in terms of AT supports and services, which could enhance their ability to transition successfully, secure CIE, and enter the job market. Tansey et al. (2015) found

that AT supports and services was more commonly provided to employed clients to stabilize and retain their jobs— a trend reflected in Studies One and Three. Chiu et al. (2015) noted that job seekers may have limited access to AT evaluations to assess their AT needs for employment. In addition, Study One findings revealed that the perceived need for AT access to support employment transitions diminishes once individuals leave K-12 and are neither enrolled in PSE nor employed, further limiting their access to AT support as they start looking for jobs. In these VR programs, AT supports and services tends to focus more on academic and job retention needs rather than on the job-seeking needs of clients, despite the potential benefits of AT in enhancing job-seeking efforts and providing more access to CIE opportunities. Study Two further revealed that, prior to the pandemic, access to AT supports and services were primarily focused on clients enrolled in academic programs to support their academic transitions, with limited access for job seekers to support their employment transitions. In Study One, the findings also revealed a negative association between increased age and the receipt of AT supports and services, with those younger in age and who had not yet completed k-12 being more likely to access AT than those who were older in age and completed k-12. This is consistent with the IDEA Amendments of 2004, which legally entitle students with disabilities to access VR and AT support until they reach age 22 or complete K-12. After this point, students must meet new eligibility requirements to apply for VR support as adults. Without an IEP team to advocate for their needs and determine AT support and accommodations, they are left to self-advocate for their needs as adults when creating their IPEs in state VR programs— a challenging leap for many (Kartovicky, 2020).

AT aimed explicitly at addressing individual needs and assisting those with significant disabilities to achieve better employment outcomes. Although those with significant disabilities have the greatest need for accessing AT supports and services, research shows they are less

likely to access AT supports and services compared to their peers without significant disabilities (Alshamrani et al., 2023). Sprong et al. (2019) found that among VR clients with significant disabilities, those who received AT had better employment success at program exit compared to those who did not. Furthermore, the National Council on Disability (2020) reported that workers with significant disabilities emphasized the essential role of AT in increasing their opportunities to successfully work in the community. Our findings in Studies One and Three revealed that TAYA with significant disabilities were less likely to receive AT supports and services than those without significant disabilities. Study Three further revealed that while TAYA with significant cognitive disabilities were more likely to access SE, they were less likely to access AT, indicating a focus on obtaining employment for this group but potentially broader AT access for those without significant cognitive disabilities. VR clients with significant disabilities typically require extended services and long-term support (Lawer et al., 2009), with Medicaid serving as the primary payer for extended services and long-term support for those with significant disabilities through HCBS waivers (Friedman, 2022). In Study Two, our focus group with Medicaid policymakers and funders highlighted challenges persisting in the HCBS waivers to support access to AT supports and services. Supportive Medicaid HCBS waivers can play a pivotal role in providing the needed access to AT, enabling this population to participate in the workforce and optimize their employment outcomes. Additionally, research shows that there is a negative relationship between receiving disability benefits and achieving employment among TAYA with significant disabilities, driven by a lack of motivation and fear of losing benefits upon employment (Gonzales et al., 2011; Kaye et al., 2008; Kaye et al., 2021; Luecking & Wittenburg, 2009). Therefore, access to AT and other VR services may not be sufficient to facilitate employment unless paired with benefits counseling (BC) services through state VR

programs. These counseling services address the concerns of clients and their families, helping them make informed decisions about employment options and potential earnings (Kaya et al., 2023; Leahy et al., 2014; Iwanaga et al., 2021).

The findings also highlight disparities in access among minority clients. Study One revealed that minority clients were less likely to access AT than White clients, a finding consistent with numerous VR studies that have documented the limited access to services, including AT, SE, and other VR services for minority clients within state VR programs (Alshamrani et al., 2023; Capella, 2002; Houseworth et al., 2022; Wilson, 2002; Bellini, 2003; Wilson & Senices, 2005; Sprong et al., 2015; Yin et al., 2022). Our findings added that minority clients, regardless of the severity of their disabilities or their enrollment in PSE, were less likely to receive AT supports and services. Specifically, minority clients with cognitive disabilities faced even lower chances of accessing AT supports and services than minority clients with other types of disabilities. The findings in Study Three further highlighted that minority clients with cognitive disabilities were less likely to access AT and SE compared to White clients with cognitive disabilities. Previous research has shown that minority clients face disadvantages at each step of the VR process—application, eligibility, service provision, and employment outcomes at closure—compared to White clients. These disadvantages included lower acceptance rates for accessing VR services. In a recent study, Yin et al. (2022) found that minority clients had lower eligibility rates, service rates, and employment rates than their White counterparts, suggesting a critical need for increased attention and research focused on improving access to services and employment outcomes among minority clients served by state VR programs.

## **Utilization of Assistive Technology in Supported Employment**

The integration of AT in SE presents an opportunity to facilitate employment transitions for TAYA job seekers with cognitive disabilities. The findings from Study Three underscore the importance of prioritizing the use of AT and SE through state VR programs to better facilitate employment transitions for this population. Customized Employment (CE), an employment strategy that builds on SE, could be instrumental in helping TAYA with cognitive disabilities secure and maintain CIE (Luhr et al., 2023). Combining CE with AT could enhance the transition process and lead to more successful transitions into CIE. Study Two highlighted how the COVID-19 pandemic increased the use of mainstream mobile devices and applications to support TAYA job seekers with cognitive disabilities in their transition to CIE. Notably, participating VR service providers reported that prior to the pandemic, TAYA job seekers with cognitive disabilities were not given opportunities to use technology. Study One further emphasized the underutilization of AT supports and services to effective support of TAYA with cognitive disabilities in their transition to CIE. Mahoehney et al. (2024) noted that while mainstream devices and applications can offer opportunities for employment access and improve employment outcomes, they have historically been under-emphasized for this population. Research indicates that video modeling and prompting techniques—delivered via apps on smartphones or tablets—can be effective for job coaching and learning job skills (Allen et al., 2010; Bross et al., 2019; Burke et al., 2013). In Study Two, some VR service providers used smartphone apps like Avail, a job training and coaching application, to assist young adult clients with cognitive disabilities in learning their jobs, executing their job tasks, and promoting their independence at work. This app is designed to assist individuals with cognitive disabilities by offering video modeling and prompting systems through pictures, videos, audio, and text to

accommodate different learning styles and cognitive abilities (Kuo et al., 2023). The findings also revealed that clients who used mainstream mobile devices also benefited from built-in accessibility features, such as text-to-speech and speech-to-text, which helped those with verbal or spelling difficulties communicate more effectively. Moreover, mainstream mobile devices now offer more built-in accessibility features designed to meet the needs of individuals with cognitive disabilities. For instance, cognitive accessibility features like Assistive Access allow users to customize their devices to reduce cognitive load, while Guided Access helps them stay focused on a single task, and the Focus feature minimizes distractions by activating specific focus areas.

The COVID-19 pandemic accelerated the adoption of virtual support as in-person services became difficult to maintain. This approach of support delivery emerged as an innovation in SE, and even as restrictions eased, recent literature indicates that virtual supports are expected to persist beyond the pandemic, with many VR service providers reporting they will continue to use virtual supports post-pandemic (Butterworth, 2021; Hartley et al., 2023; Mahoehney et al., 2024; Timmons et al., 2022). Our findings in Study Two reinforce these findings, as most service provider participants interviewed expressed a desire to continue to offer virtual support post-pandemic. Research suggests that virtual support holds promise for increasing service accessibility, inclusivity, and efficiency in better serving clients with disabilities (Ahonle et al., 2021; Akemoglu et al., 2021; Hinton et al., 2023; Mahoehney et al., 2024; Ottomanelli et al., 2021; Tassé et al., 2020), particularly for TAYA job seekers with cognitive disabilities in underserved communities who frequently face barriers in accessing employment and support services (Burd-Sharps & Lewis, 2017; Bray et al., 2016). In Study Two, participating VR service providers used electronic documents and online platforms like

Microsoft Teams for offering job development, training, and coaching, but these were often not reviewed for cognitive accessibility. Gartland et al. (2022) emphasize that the pandemic, along with the increased use of digital technologies in service delivery, underscores the urgent need to understand how individuals with cognitive disabilities interact with such technologies to perform better in job-related tasks and access employment resources more efficiently. The need to ensure that digital tools are accessible is further underscored by the Americans with Disabilities Act (ADA) Title II's new rulemaking, which extends accessibility requirements to web and mobile applications (U.S. Department of Justice, 2023). Overall, virtual support offers a promising solution for addressing accessibility barriers in SE for TAYA with cognitive disabilities, making SE support more inclusive to accommodate clients' diverse needs, and leveraging the use of mainstream mobile devices and applications to better assist them in finding and maintaining CIE. This approach of support delivery is one component of holistic SE service delivery that emphasizes a client-centered approach. This includes involving clients in the decision-making process when selecting devices/applications and support delivery methods, ensuring the support provided is accessible, relevant, and aligned with client' needs, preferences, and employment goals.

### **Association with Competitive Integrated Employment Outcomes**

Study Three revealed that more than half of TAYA with cognitive disabilities did not achieve CIE at program exit, underscoring the challenges this population faces in achieving CIE. This finding aligns with previous research (Burgess & Cimeria, 2014; Chen et al., 2015; Cimeria & Cowan, 2009; Kaya, 2018; Lawer et al., 2009; Migliore et al., 2014), which highlights poor employment outcomes for TAYA with cognitive disabilities at program exit. Additionally, our findings indicate that among TAYA with cognitive disabilities, certain sociodemographic

characteristics were associated with a lower likelihood of achieving CIE at exit. These include TAYA with cognitive disabilities who were not enrolled in PSE, were unemployed, had significant disabilities, and were minorities. Overall, our findings demonstrated that TAYA with cognitive disabilities who received AT and SE support were more likely to achieve CIE outcomes upon exiting the program compared to those who did not receive such support. Specifically, across the three COVID periods, TAYA with cognitive disabilities who received AT and SE showed improved probabilities of achieving CIE, with better CIE outcomes during and post-COVID than pre-COVID. These findings highlight the need to reevaluate and integrate AT and SE into state VR transition strategies to address the job-seeking needs of TAYA with cognitive disabilities and optimize their CIE outcomes. This may help facilitate more successful transitions into CIE at program exit and help bridge the employment gap for this population. Continued efforts to enhance transition policies, improve services and supports, and train service providers on providing effective AT evaluation and support for this population to ensure equitable access, employment opportunities, and support they need for employment success.

### **Future Research Directions**

Most existing studies on VR services provided through state VR programs are retrospective, relying on secondary analysis of RSA-911 data. While those data are valuable for identifying disparities in access, patterns, and statistical associations between the receipt of VR services and employment outcomes at program exit, it is primarily designed for administrative purposes rather than research. This limitation results in a lack of detailed information necessary for understanding the factors influencing these outcomes. Future research could benefit from an explanatory sequential mixed-methods design, starting with quantitative RSA-911 data collection to identify patterns or issues, followed by qualitative data collection to explore and explain these

findings in more depth. This approach allows researchers to identify issues or patterns through quantitative analysis of RSA-911 and then gain a deeper understanding of the underlying reasons and contextual factors using qualitative methods. The collective findings from this dissertation revealed overall poor employment outcomes among TAYA with cognitive disabilities, with certain sociodemographic characteristics significantly associated with a lower likelihood of achieving CIE at exit, such as individuals with significant disabilities, those from low-income or minority backgrounds, unemployed individuals, and those not enrolled in PSE. Future research should explore the underlying reasons and barriers these subgroups face in more depth because understanding them is essential for developing targeted employment transition interventions that address their specific challenges. Without a thorough examination, efforts to improve employment outcomes for these populations may be less effective. By identifying and addressing the causes, future research can inform policies and practices that more effectively support these vulnerable groups in their transition to employment.

In addition, the Rehabilitation Act of 1973 highlights the importance of promoting community inclusion, independence, and equal access to resources and employment opportunities. This legislation builds on the social model of disability, asserting that disability is a natural part of the human experience and should not affect an individual's right to pursue jobs or to be fully included in society (Pub. L. No. 93-112, 87 Stat. 355). The social model differs from the medical model, which views disabilities primarily as a medical issue requiring treatment and fails to consider the societal barriers that contribute to disability. The social model of disability advocates for individual empowerment, social inclusion, and individual choices, which are relevant in facilitating CIE for individuals with disabilities. Integrating the HAAT, a client-centered framework, within the social model framework supports advocacy for inclusive

technologies and environments, underlining the necessity of implementing AT that is not only functionally effective but also socially inclusive and serves as an enabling tool. The HAAT model considers AT as an enabler, potentially reducing the impact of disability by compensating for impairments. This use of AT to empower social participation and independence is an application of the social model's focus on creating an inclusive environment and ensuring equitable access to beneficial resources. By aligning future research with the social model and using the HAAT model in conjunction with the social model of disability, researchers can guide VR practitioners to better design, implement, and advocate for AT that enhances the participation of individuals with disabilities in society, including CIE.

Our findings highlight a gap in the use of AT support to assist clients in their transitions into employment. This support is particularly underutilized among TAYA job seekers with cognitive disabilities. Future research should explore the experiences of VR personnel, including state VR counselors and comparable benefits providers, in conducting effective AT evaluations and training on AT use, or in referring to a subcontractor for an AT evaluation and training, to assist this population in their employment transitions. Such research could uncover challenges and identify potential gaps contributing to the underutilization of AT support among this population served by state VR programs. Research in this area could also assess how well current educational rehabilitation programs prepare and train future professionals to effectively support clients through AT services.

Limited research exists on VR studies addressing the role of AT support in facilitating transitions among TAYA with cognitive disabilities. Addressing this research gap is crucial for developing effective strategies to support this population who need and could benefit from AT support in their transitions. There is a need for research that examines states' transition plans

regarding the use of AT support in assisting TAYA job seekers with disabilities as they transition into employment. This research should specifically focus on TAYA job seekers with cognitive disabilities, who represent the largest disability group among transition-aged population in state VR programs and have been identified as having poor transition outcomes at exit. Moreover, research on the effectiveness and usability of existing and emerging technologies for employment-related purposes, particularly for TAYA with cognitive disabilities, and how they can be leveraged to support their transition into employment is worth investigating due to the dearth of research in this area. A review of the accessibility of these technologies for people with cognitive disabilities is also a necessary area of future research.

While progress has been made in researching AT effectiveness and implementing best AT practices in educational settings for TAYA with disabilities, there remains a lack of research focused on vocational settings, particularly for TAYA with cognitive disabilities, and how to implement best AT practices in a practical and feasible manner within vocational settings for this population, are worth investigating due to the dearth of research in this area. Moreover, the IDEA regulations specify that no participating agency, including state VR agencies, is relieved of the responsibility to provide or pay for any transition service, including AT devices and services (34 C.F.R. § 300.324(c)(2)). State VR programs often collaborate with K-12 schools, identifying students' AT needs from IEPs upon application, thus including the AT support in IPE to be funded and provided by the state VR program. Under the most recent WIOA act of 2014, state VR programs are mandated to coordinate with local workforce centers and educational institutions, including higher education and PSE institutions, to ensure that TAYA with disabilities receive the necessary support to achieve their educational and employment goals. This collaboration is intended to create a seamless transition for TAYA with disabilities from the

education system to CIE. It includes sharing resources, coordinating support services, and aligning goals to meet the needs of TAYA with disabilities (Pub. L. No. 113-128, 128 Stat. 1425). However, much remains unknown about the adult system's collaboration for AT support. Future research is needed to explore the challenges and benefits of a team-based approach in the adult system, particularly with the inclusion of higher education and PSE personnel. Such collaborative partnerships between state VR programs and educational institutions could enhance access to essential AT support, optimize AT support delivery, leverage the AT that students with disabilities already use as they transition into employment and/or further education for this population.

Our results showed that TAYA with cognitive disabilities who accessed AT support achieved successful CIE outcomes at program exit during COVID compared to pre-COVID, and this pattern remained stable post-COVID with no significant association. Additionally, the probabilities of achieving CIE were higher among those receiving AT support during the COVID and post-COVID periods than pre-COVID. However, the Study Three has a small number of post-COVID participants who were available in data at the time of conducting the research. Future research could include additional program years following the pandemic to fully capture the impact of AT support post-COVID on achieving CIE outcomes at program exit.

The COVID-19 pandemic has provided valuable lessons and insights that could help break employment barriers for TAYA with cognitive disabilities. Research suggests that virtual support has the potential to increase service accessibility, inclusivity, and efficiency, ultimately better serving this population. These lessons present a unique opportunity to rethink and improve employment outcomes in the post-pandemic era. However, much remains to be explored, particularly in the SE field. With state policies approving virtual support and the continued

growth of technology in SE post-pandemic, future research could focus on how these adaptive and innovative supports influence clients' CIE outcomes.

Additionally, with the rise of using mainstream mobile devices and applications in SE support for those with cognitive disabilities, further research is needed to evaluate the effectiveness of these technologies, particularly in the areas of job training and coaching, with the aim of informing best practices. This also highlights the urgent need to understand how individuals with cognitive disabilities interact with technology to perform better in job-related tasks and access employment resources more effectively. Future research could involve reviewing web and mobile applications for accessibility, especially if these technologies are employed more in SE to support job seekers with cognitive disabilities in searching for, securing, and maintaining CIE. Moreover, we suggest that future research would benefit from a scoping review study to map existing literature to identify research gaps, provide recommendations for future directions, and inform practice in the field.

## **Contributions to Occupational and Rehabilitation Science (ORS)**

### **Contributions to the Field of Occupation Science (OS)**

This dissertation makes contributions to the field of OS by demonstrating the intricate nature of human occupations and the influence of other contexts on occupational engagement. Building upon prior research, it examines factors that affect employment and provides new knowledge and insights into the determinants of access to AT and CIE for TAYA with cognitive disabilities served by state VR programs. In alignment with OS's core emphasis on meaningful occupation as essential for health and well-being (Molineux, 2010; Yerxa, 1990), this dissertation explored how AT enables such engagement in meaningful employment for TAYA with cognitive disabilities. Adopting a transactional approach, this dissertation examined both

the dynamic interactions between personal factors and the external factors that influence occupational engagement (Dickie, 2006). It contributed to offering a better understanding of how these factors impact occupational engagement of TAYA with cognitive disabilities. Given that engagement in occupation is fundamental to life—through active interactions with people and environments, individuals develop a sense of competence, purpose, and belonging, all of which are vital to identity, meaning in life, personal growth, health, and well-being (Christiansen, 1999; Matuska & Christiansen, 2008)—this dissertation focuses on the importance of engagement of individuals in CIE, a work environment where individuals experience a profound sense of competence, purpose, and belonging, reinforcing these essential elements. The research highlights the potential of AT to assist TAYA with cognitive disabilities to work in CIE to regain these essential elements of human experience. Lastly, this dissertation addresses the issue of occupational justice, which advocates for equal opportunities and resources for all individuals to engage in meaningful occupations (Hocking, 2017; Townsend & Wilcock, 2004). The dissertation contributed to a better understanding of the facilitators and barriers to accessing AT support, and how limited access can lead to injustice by restricting individuals' opportunities to engage in CIE. This dissertation underscores the importance of promoting equal access and recognizing the occupational value that AT can offer for TAYA with cognitive disabilities.

This research contributes to OT practice by enhancing the understanding and implementation of AT in ways that support engagement in occupations and address broader issues of occupational justice and empowerment. Central to the foundational goals of OT, our research emphasizes the critical role of employment for health and well-being. We investigated how AT supports engagement and participation in the social occupation—CIE—a key area where individuals with disabilities interact actively with others and work in inclusive

environments. Our research enhances the understanding of factors that facilitate or impede participation in occupations, offering insights into how to better support occupational engagement. We also addressed occupational justice, advocating for equal opportunities and resources for all individuals to engage in meaningful CIE. Moreover, our research promotes a client-centered approach, prioritizing client empowerment by enhancing accessibility and providing the necessary resources and opportunities for individuals with disabilities. This approach ensures that AT interventions are carefully planned and implemented to meet individual needs, reinforcing OT's commitment to empowering those with disabilities to engage and participate in their chosen occupations. Our research has also identified existing gaps and calls for policy changes. This advocacy effort supports OT's role in facilitating engagement in meaningful occupations, reinforcing the profession's dedication to enhancing the quality of life for those with disabilities, and promoting equitable engagement in occupations. Overall, our contributions align with the core principles of OT, enriching the profession's capacity to empower and integrate AT in practices, advocating for the rights of those with disabilities, and achieving broader societal impacts through occupational justice and empowerment.

### **Contributions to the Field of Rehabilitation Science (RS)**

This dissertation makes contributions to the field of RS by deepening the understanding of the complex interactions between personal and environmental factors that shape disability, while also providing implications and recommendations to improve employment for TAYA with cognitive disabilities. RS emphasizes that disability is not solely a result of personal factors but is also influenced by environmental factors that can either enable or disable participation in daily activities (Baum, 2011; Brandt & Pope, 1997; Seelman, 2000; Stucki, 2005). This research explores how the interaction between personal factors (such as age, sex, employment status,

income, race, disability type, education, and severity of disability) and environmental factors (including policy, funding, VR personnel training, accessibility to AT, and other support services) either enables or disables the participation of TAYA with cognitive disabilities in meaningful activities, particularly CIE. By examining these dynamics, the dissertation aligns with the ICF and the enabling-disabling process models, providing a view of how disability is shaped by other factors beyond personal factors. With a better understanding of the influential factors that impact CIE outcomes among this population, this dissertation contributes to RS by informing policies and practices that create more supportive environments for TAYA with cognitive disabilities to participate in CIE. The findings help in supporting the efforts of transition-related policy and practice to target these factors that are beyond a person's disability, enable accessibility, reduce disparities, and enhance CIE outcomes. The findings also extended to VR personnel working with this population, offering implications and recommendations for using effective approaches to enhance the quality of support provided and, ultimately, the CIE outcomes for TAYA with cognitive disabilities.

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## APPENDIX A

### Focus group interview guide

Focus group	Question Prompts
Service providers	<ol style="list-style-type: none"> <li>1. Can you describe how your job duties or daily routines were impacted, or changed as a result of the COVID 19 pandemic?</li> <li>2. Are there any approaches that you utilize to interact with individuals with disabilities?</li> <li>3. Have you worked with clients using technology? How did they access technology?</li> <li>4. Can you describe what worked well for providing supported employment services to your clients and what you will continue to use after pandemic?</li> <li>5. How are you moving forward in terms of either efficiency or effectiveness working with the clients, in terms of providing supported employment services?</li> <li>6. Anything particularly challenging for the individuals you are working with, or maybe within your own agencies as a result of the pandemic?</li> <li>7. Can you describe how employers responded to the use of technology in the workplace? And did you feel that the use of technology options was well received to meet the needs of the employees and employers?</li> </ol>
Policymakers and funders	<ol style="list-style-type: none"> <li>1. What funding mechanisms were in place during the COVID 19 pandemic to pay for any type of technology?</li> <li>2. What types of modifications to policy or funding had to be made to account for the technology or to make that technology available?</li> <li>3. What kind of those supported employment services that you had to look at? Providing in a way that you maybe you had not done prior to the pandemic?</li> <li>4. What do you think the impact would have been on job seekers during the pandemic, if you had not been able to make this shift and be resilient and nimble to provide access to technology? What would have been that impact to job seekers?</li> <li>5. What does supported employment look like now on the DVR/Medicaid side?</li> <li>6. What policy elements have been introduced during the pandemic and you think will continue after the pandemic?</li> </ol>

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Employers

1. Have you ever hired individuals or had interns with disclosed disabilities?
2. Can you describe your working with service providers prior to the pandemic and now?
3. How did the pandemic impact your ability to have service providers on site?
4. Can you describe if or how your business/organization changed their hiring practices, or their training procedures during the pandemic?
5. At the start of the pandemic, what format did you utilize for your business operations?
6. Can you describe the technologies that are used on your job site and include people with disclosed disabilities are responsible for the use of these technologies?
7. Can you describe how these technologies may impact the quality of work for the employees with disabilities you have hired or will hire?
8. How do you think your employees could be better supported moving forward? How can you better support individuals with disclosed disabilities?

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Individuals and family members

1. If you were receiving support with finding and applying for jobs at any time during the pandemic, can you describe your experience?
  2. What type of technologies were you using?
  3. If you worked with a supported employment service provider, how were you be supported? Were there any technologies involved?
  4. Have there been any forms of technology that have made it more beneficial for you either working with a job coach or performing on the job site?
  5. What challenges do you remember facing with technology and how did you overcome them?
  6. What recommendations do you have for supported employment services moving forward? What information have you learned that you would like service providers to know?
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## APPENDIX B

### Glossary of terms

Term	Definition
Assistive Technology (AT)	<p>The standard federal definition of an AT device is “<i>any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities</i>” (Pub. L. No. 108–364, 118 Stat, 1710). This broad definition covers any piece of technology that can assist an individual with a disability, including mainstream mobile devices and applications. AT services are defined as “<i>any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device</i>” (Pub. L. No. 108–364, 118 Stat, 1710). This assistance can include the evaluation of the needs, acquiring/selecting a device, and training on the use of the device (RSA, 2019).</p>
Auditory Disabilities	<p>Auditory disabilities encompass hearing impairments, including deafness and auditory processing disorders, such as tinnitus, Meniere's disease, hyperacusis, and other auditory-related disorders.</p>
Cognitive Disabilities	<p>Federal definitions of cognitive disability, encompassing difficulties with learning, thinking, processing information, concentrating, remembering, filtering distractions, time management, planning, problem-solving, decision-making, communication, and social functioning. Examples of such disabilities include intellectual disability, autism spectrum disorder, learning disabilities, attention-deficit/hyperactivity disorder, and attention-deficit disorder.</p>

Competitive Integrated Employment (CIE)

Employment in a job that is performed on a full-time or part-time basis for which an individual is paid the same wage by the employer for the same or similar work performed by other employees without disabilities, in a fully integrated location with competitive wages and opportunities for advancement (34 CFR 361.5(c)(9)).

COVID-19 Pandemic Period

This period refers to the time when the SARS-CoV-2 virus caused a global outbreak from March 2020 to July 2021. This period categorization is based on the World Health Organization's declaration of COVID-19 as a pandemic on March 11, 2020, the government executive orders for Colorado's declaration of a state of emergency in response to COVID-19 on the same date (D 2020-003), and the termination of the state of emergency on July 8, 2021 (D 2021-122). The pandemic led to public health measures such as lockdowns, social distancing, mask mandates, PCR testing, and reduced in-person interactions, profoundly impacting society, daily life, economies, employment, and services provided in both public and private sectors, while also influencing policies and practices.

Focus Group Study

A focus group study is a qualitative research method that involves guided discussions with a small group of participants to explore their perspectives and experiences on a specific topic. The group typically comprises participants who share characteristics relevant to the research topic. A trained primary facilitator leads the discussion, encouraging participant interaction and ensuring all voices are heard. One or two secondary facilitators assist by taking notes, asking follow-up and probing questions for clarity, and encouraging further discussion among the participants.

IBM SPSS Statistics Software

IBM SPSS Statistics is a software package widely used for statistical quantitative analysis. It allows users to perform various statistical tests, data management, and data visualization. Researchers can use SPSS to analyze complex data sets, generate descriptive statistics, conduct inferential analyses, and create graphs.

Low-income

State VR programs characterize a low-income individual as someone who meets at least one of the following criteria:

1. Currently receives or has received within the last six months before applying for state VR programs, government assistance such as the Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), or Supplemental Security Income (SSI).
2. Is an individual with disabilities living with a family whose total family income is below the poverty level.
3. Is an individual with disabilities whose income is below the poverty level.

Mental Disabilities

Mental disabilities encompass mental health conditions such as depressive and other mood disorders, anxiety disorders, eating disorders, personality disorders, schizophrenia and other psychotic disorders, obsessive-compulsive disorder, and other mental health-related disorders.

Minority

This term refers to racial/ethnic minority groups such as American Indian or Alaska Native, Asian, African American, Native Hawaiian or other Pacific Islander, and Hispanic.

Multiple Regression Analysis

Multiple regression analysis is a statistical technique used to examine the relationship between one dependent variable and two or more independent variables. It allows researchers to

assess how different factors or predictors contribute to the outcome of interest while controlling for the influence of other variables in the model. This method also enables the analysis of interaction effects, which occur when the effect of one independent variable on the dependent variable depends on the level of another independent variable.

NVivo Qualitative Data Analysis Software

NVivo is specialized software designed for qualitative data analysis, enabling researchers to manage, code, and analyze data from sources such as interviews, focus groups, survey responses, and other text-based content. Researchers use NVivo to organize, code, identify themes, and explore patterns within qualitative data. It is used to assist in the analysis of data in qualitative studies.

Otter.ai Software

Otter.ai is advanced transcription software that uses artificial intelligence to convert audio or video into written text. It is a helpful tool for researchers, but the output often needs to be reviewed for accuracy.

Physical Disabilities

Physical disabilities encompass physical impairments, including amputations, muscular dystrophy, polio, multiple sclerosis, and other physical-related disorders.

Rehabilitation Services Administration (RSA)

RSA is a federal agency within the U.S. Department of Education (DOE) responsible for administering and overseeing state VR programs. RSA monitors and evaluates the performance of state VR programs to ensure they meet federal standards and achieve desired outcomes in serving individuals with disabilities.

Rehabilitation Services Administration Case Service Report (RSA-911)

The RSA-911 is administrative data collected annually by state VR programs and submitted to the RSA. The dataset contains detailed records on

all individuals who applied for and participated in state VR programs, reported by VR counselors when each case is opened and closed. This includes information regarding demographics, services provided, and employment outcomes achieved by individuals with disabilities upon case closure.

#### Retrospective Cross-Sectional Study

A retrospective cross-sectional study is a type of quantitative observational research study where data is collected at a time from past records or events. Researchers examine the relationships between variables based on pre-existing data to identify associations. This study design is commonly used to investigate the outcomes in a population and explore potential factors or predictors by analyzing historical data.

#### Significant Disability

Significant disability indicates a disability that seriously limits one or more functional capacities in terms of employment. An individual with a significant disability is an individual who has a severe disability that impacts their ability to obtain or maintain employment. Such individuals typically have complex needs and require more VR services than those with a non-significant disability.

#### State Vocational Rehabilitation (VR) Programs

Programs that receive federal funding to provide vocational services to individuals with disabilities, helping them prepare for, search for, secure, retain, advance in, or regain employment.

#### Supported Employment (SE)

SE services are ongoing support services provided to assist individuals with disabilities in obtaining and maintaining CIE (34 CFR 361.5(c)(54)). SE, which may include customized employment, is tailored based on the individual's needs as outlined in their individualized plan for employment. These services assist job seekers through job discovery

and search, securing employment through job placement, identifying training needs for job skills, and providing on-the-job support through job coaching. SE services are typically offered for up to four years or until the individual reaches the age of 25, whichever comes first (34 CFR 361.5(c)(58)).

### Thematic Analysis

Thematic analysis is a qualitative research method used to identify, analyze, and interpret patterns or themes within a set of data. This approach involves coding the data, grouping similar codes together, and then developing broader themes that capture the underlying meaning across the dataset. It allows researchers to provide a rich, detailed, and nuanced understanding of complex qualitative data. Braun and Clarke (2006) outline six steps for thematic analysis: familiarization, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing a final report.

### Transition-Aged Young Adults (TAYA)

This term is commonly used in the field of special education, vocational rehabilitation, disability services, and policies. It refers to young adults with disabilities between the ages of 18 and 24, who are in the process of transitioning to adulthood. During this phase, they are eligible for various transition services, including AT, SE, and other services through state VR programs to facilitate their transition from education to CIE.

### Visual Disabilities

Visual disabilities encompass visual impairments, including blindness, low vision, and color blindness, as well as visual processing disorders such as visual discrimination, visual sequencing, visual-spatial, visual closure, and other visual-related disorders.