Intellectual and Developmental Disabilities

Technology Access, Utility, and Unmet Needs: Results from the Arc's FINDS Survey --Manuscript Draft--

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Abstract:	Technology can enhance the quality of life of people with intellectual and developmental disabilities (IDD). However, little is known about the extent to which it is accessible to and useful for people with IDD and their caregivers from different backgrounds. A secondary analysis was conducted using 3,113 caregiver responses from the Arc's Family and Individual Needs for Disability Supports Survey to explore associations between technology access, utility, unmet needs, and various demographic characteristics of individuals with IDD and their families. Overall, reports of family members with IDD being older, employed, having more education, less health-related needs, and greater access to state-based services were associated with technology being reported as accessible and useful. Implications for research, practice, and policy are discussed.	

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TECHNOLOGY ACCESS, UTILITY, AND UNMET NEEDS

Abstract

Technology can enhance the quality of life of people with intellectual and developmental disabilities (IDD). However, little is known about the extent to which it is accessible to and useful for people with IDD and their caregivers from different backgrounds. A secondary analysis was conducted using 3,113 caregiver responses from the Arc's *Family and Individual Needs for Disability Supports Survey* to explore associations between technology access, utility, unmet needs, and various demographic characteristics of individuals with IDD and their families. Overall, reports of family members with IDD being older, employed, having more education, less health-related needs, and greater access to state-based services were associated with technology being reported as accessible and useful. Implications for research, practice, and policy are discussed.

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Across the lifespan, technology has the potential to have a major, positive influence on the lives of people with intellectual and developmental disabilities (PWIDD) enhancing outcomes associated with education, employment, social interaction, independence, and quality of life (Boot et al., 2018, 2020; Friedman, 2023; O'Brolcháin, 2018; Owuor et al., 2018). Technology can be used to assist in service planning, activities of daily living (e.g., grocery shopping, public transportation), employment and social supports, physical health, and access to recreational/leisure activities. Technology can also be used to support the acquisition of a variety of skills associated with positive life outcomes, including communication, money management, cooking, community navigation, and self-determination (Boot et al., 2018; Devi & Sarkar, 2019; Erdem, 2017; Mahmoudi et al., in preparation; Raja, 2016; Söderström et al., 2021).

In recent years, a variety of assistive technologies (AT) have been used both within and outside of educational settings to support learning and skill development of children as well as adults with IDD. ATs have been found to support the development of language (Fteiha, 2017; Rodríguez & Cumming, 2017), reading, writing, mathematics (Bouck et al., 2020; Nordström et al., 2018; Svensson et al., 2021), social (Syriopoulou-Delli & Gkiolnta, 2022; Tsikinas & Xinogalos, 2019), communication (Silvera-Tawil, et al., 2018), motor (Clark et al., 2021), and computer skills (Erdem, 2017). Computer-based platforms (e.g., Whose Future Is it?) used by teachers to deliver accessible instruction on transition-planning skills to youth with IDD have also demonstrated their efficacy (Shogren et al., 2018, 2020). In addition, technology has been found to support greater community access and inclusion among PWIDD through supporting navigation skills and use of transportation systems (Price et al., 2018; Smith et al., 2017) as well as leisure activities of people with IDD (Lancioni et al., 2020a, 2020b). In relation to employment, multimedia programs and virtual reality-based applications have shown promise in

improving interviewing skills (Smith et al., 2014; Strickland et al., 2013; Walker et al., 2019), facilitating social skill development and employment preparation (Walker et al., 2019), as well as supporting selection of preferred over non-preferred types of employment (Davies et al., 2018).

Barriers and the Importance of Access to Technology

Despite the range of promising technologies that exist to support people with disabilities, those who need it the most, including PWIDD, often do not have access (Burke & Heller, 2017; Friedman, 2023; United Nations, 2019; World Health Organization [WHO)], 2022)). There are several barriers that PWIDD and their families face to accessing technology-based supports (Boot et al., 2018; Devi & Sarkar, 2019; Khanlou et al., 2020; WHO, 2022). A critical barrier is a lack of knowledge and awareness on the part of educators, employers, and family members of the potential of technology to enhance quality of life, limiting both access and utility (Boot et al., 2018; Raja, 2016). The affordability of technology also continues to be a common issue that limits its use. (Boot et al., 2018, 2020; Khanlou et al., 2020; Raja, 2016). Due to the continued high cost of many types of technology, PWIDD and their families all too often remain dependent on schools and state technology programs to fund the purchase. Too often, this means a PWIDD can only use limited features of the technology or not take it home with them.

Limited technology access and utility is also a result of a general lack of training provided to PWIDD and their families about how to use different technologies and effectively problem-solve when technology is not working as intended (Boot et al., 2020; Khanlou et al., 2020). Although technologies such as iPads and mobile phones have endless uses, for many PWIDD, the use of such technology is typically limited to entertainment, instructional videos, and teaching social and communication skills (e.g., Browder et al., 2017; Odom et al., 2015; Logan et al., 2017). These barriers have a negative impact on the potential of technology to support better outcomes in education, daily living, employment, and community inclusion (Khanlou et al., 2020).

Gaps in the Empirical Literature

Previous research has identified a number of barriers connected with access to and the utility of technology to PWIDD. There is limited information available, however, with respect to those personal and family factors associated with the availability and ease of use of technology, its utility, and unmet needs (Friedman, 2023). PWIDD who come from White, middle to upper middle-class families and live in urban or suburban areas may have greater access to technology than individuals of color, of low socio-economic status, and/or who reside in rural or frontier environments. Due to the lack of empirical literature covering technology access and use among PWIDD, it is unclear as to the extent to which the current system engenders equity with respect to technology access and usage and which groups of people have greater difficulty accessing and utilizing technology. Furthermore, the current literature does little to inform us as to the extent to which PWIDDD have access to technology that is useful in different life domains, including school, work, community integration, and self-determination. A greater understanding of gaps and barriers as well as unmet needs in this area has the potential to guide future efforts to address social ecological factors that limit the effectiveness of technology to support enhanced outcomes in education, employment, and community living.

The Family and Individual Needs for Disability Supports Survey

The Family and Individual Needs for Disability Supports (FINDS) survey was used as the data source for analyzing the extent to which characteristics of PWIDD and their caregivers are associated with access to assistive technology, its utility, and unmet needs in this area. The FINDS survey originated from the Arc of the United States, established in the 1950s to champion the human rights of individuals with IDD, and advocate for their inclusion and active participation in the community (The Arc, 2023). The purpose of the FINDS survey is to gain information and understanding of the experiences of PWIDD, their families, and/or unrelated caregivers who provide support. First used in 2010 and administered every three years, the survey is unique in that recruitment efforts include not only families receiving services but also those who are not currently accessing any local, state, or federally funded support programs.

Core information collected through the FINDS survey includes data with respect to the experiences of PWIDD and their caregivers across a wide variety of domains, including degree of caregiving, demographics of caregivers and PWIDD, caregiver employer benefits, financial support, service needs and access, residential and guardianship arrangements, and the educational and employment backgrounds of both caregivers and their family member with IDD.

Through a collaboration between the University of Minnesota's Research and Training Center on Community Living (RTC/CL) and The Arc, the survey was updated in 2017 and 2023. In the 2023 version, a number of questions were added related to technology. Although the FINDS survey is not intended to be a comprehensive source specifically addressing technology, the combination of information related to family experiences with technology, the demographics of caregivers and family members with IDD, and other quality of life information from the survey provided a unique opportunity to investigate the extent to which there are associations between such characteristics and access to technology, its utility, and unmet needs.

Study Purpose

The current study was exploratory in nature, with the purpose of investigating the extent to which characteristics of PWIDD and their caregivers are associated with access to and the utility of technology. Specific research questions were as follows:

1. What is the degree to which PWIDD and their caregivers have access to technology with respect to education, employment, community inclusion, and self-determination based on

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characteristics of individuals with IDD and their caregivers (i.e. age, race/ethnicity, linguistic preference, education level, socioeconomic and employment status, level of health-related needs, waiting list status, geographic area of residence)?

- 2. What is the degree to which technology is viewed as having utility within the context of education, employment, community integration, and self-determination based on characteristics of individuals with IDD and their caregivers?
- 3. What is the degree to which PWIDD and their families have unmet technology needs with respect to education, employment, community inclusion, and self-determination based on characteristics of individuals with IDD and their caregivers?
- 4. What is the degree to which there is an association between state-based funding per capita for Medicaid waivered services and reports of technology access, utility, and unmet needs?

Method

Sample

The current study is focused on a secondary analysis of data from the FINDS survey, based on the responses of a convenience sample of 3,113 caregivers of PWIDD across the United States. This sample included both caregivers and PWIDD receiving home and community-based or other supports as well as those who do not. The 2023 survey, hosted on the University's Qualtrics platform, was overseen by researchers associated with the University of Minnesota's Institute on Community Integration in collaboration with The Arc. The online survey was distributed to all states and territories which engendered a sample of respondents from 50 states, the District of Columbia, American Samoa, the Northern Mariana Islands, Puerto Rico, and the US Virgin Islands. Inclusion criteria for survey participation included: a) being 18 years of age or older, b) being a caregiver whose primary relationship with an individual with IDD was not as a direct support professional (DSP) or paid supporter, and c) having provided support or care to a child or adult with IDD within the past 12 months. Participants were recruited via social media sites, state and local chapters of the Arc, and national organizations including the Association of University Centers on Disabilities and Parent-to-Parent organizations. Surveys were administered online via Qualtrics over a one-month period between January and February 2023. Prior to completing the survey, respondents were provided with background information, risks and benefits of the study, and statements with respect to confidentiality, the voluntary nature of the study, compensation, and a contact person.

Of the 7,031 surveys submitted via Qualtrics, approximately half were identified as failing to meet inclusion criteria, incomplete, bot responses, or spam. The final number of responses included in the analysis was therefore 3,113 completed surveys. Six respondents who completed the survey were selected from a lottery to receive \$250 for participating.

Measures

Dependent variables.

The dependent variables (or "outcomes") in the current study consist of a) access to technology, b) utility of accessed technology, and c) unmet needs of caregivers and the individuals with IDD they support. These are composite variables, based on multiple technology-related items in the FINDS survey which were defined and constructed in collaboration with the research team and collaborators of the Arc (see Table 1). Each dependent variable assesses the identified technology outcomes within four quality of life domains: school, employment, community integration, and self-determination. Survey items Q101, Q103, and Q104 of the FINDS survey each have nine components related to these domains. Table 2 outlines the components that were paired with each life domain. In order to identify more meaningful

associations between the dependent variables (i.e., technology access, utility, and unmet needs), these outcomes were analyzed separately for each life domain under investigation.

Technology access for this study is defined as the extent to which technology-based support is available, easy to use, and the degree to which a person can obtain technical assistance when needed. This variable was a composite of items querying the extent to which PWIDD had access to technology across a variety of life domains (Q101), if the technology was easy to use (Q104), and if there was access to technology support when needed (Q105).

Technology utility is defined as the extent to which technology support was viewed as helpful to a family member with IDD (Q103). Although this variable is constructed from a stand -alone item present in the other composite variables, we deemed the utility (i.e., helpfulness) of technology to be of unique importance since it specifically targets *areas* of technology applicability rather than the *relationship* between the person with IDD and technology. This variable is also dichotomized as to whether or not participants indicated technology had utility within at least 50% of the components within a life domain.

Unmet technology needs is operationalized as the extent to which technology supports are unhelpful or would be considered helpful but are not accessible/available. This composite was a combination of survey items focused on whether the individual with IDD had access to technology across a variety of life domains (Q101), whether access was helpful within those domains (Q103), and if the technology was easy to use (Q104). There were two ways items were combined to create the composite. The first centered on whether a person had access to a specific technology, but it was not viewed as either helpful or easy to use. The second was based on whether a specific technology was viewed as helpful, but the person did not have that technology available. This composite was then dichotomized for inferential modeling, indicating whether or not a person had at least one unmet need with a domain.

Independent variables.

The independent variables (or "predictors") used in the current study include characteristics of caregivers and family members with IDD. These include, age, race/ethnicity, linguistic preference, education level, socioeconomic status, employment status, health-related needs, waiting list status for services, and geographic area of residence. An additional predictor included state-level funding per capita of disability support services.

After initial data cleaning and review, race and language-spoken for both caregivers and family members with IDD were dropped from inferential analyses due to a disproportionate number of White and English-speaking participants in the sample. In addition, a composite SES measure for persons with IDD was eschewed in favor of separate measures of the person's employment status and level of education. The U.S. region of persons with IDD was inferred from their reported state residence and the U.S. Census Bureau's classification of those states (U.S. Census Bureau, n.d.). Finally, it is noted here that age was assessed on ordinal ranges in 10-year intervals, starting at 18 for caregivers and zero for PWIDD.

Research Design

Secondary analysis of the FINDS data was undertaken to gain descriptive information related to the characteristics of caregivers and family members with IDD using technology supports and investigate associations between individual and family characteristics and technology access, unmet needs, and utility in the life domains of school, employment, community integration, and self-determination. Quantitative analyses were performed in R (Version 4.3.1) and IBM SPSS (Version 27).

Data Analysis

Data analysis was separated into descriptive statistics and inferential linear modeling, the latter performed in R Linear (LMM) and generalized (GLMM) mixed-effects models (see

Faraway, 2016) were fit using the lme4 package (Bates et al., 2015) and estimated with restricted maximum likelihood. "Mixed effects" describes a wide range of models that incorporate both fixed and random effects in the modeling procedure. Random effects are included to account for correlated observations (e.g. longitudinal or hierarchical – multilevel, data). Participants responding to the FINDS survey were nested within U.S. states, the latter nested within U.S. regions. LMMs and GLMMs were used to model this multilevel structure. In addition, the maximum likelihood procedures used to fit these models are well-suited for the unbalanced categorical predictors present in our data. Significance tests of model coefficients were done with the car package using the Kenward-Roger F tests (LMMs) or type III Wald chi-square tests (GLMMs; Fox & Weisberg, 2019). Post hoc pairwise comparisons for categorical predictors, and construction of their simultaneous confidence intervals, were done using the multcomp package (Hothorn et al., 2008). The familywise error rate for all comparisons was controlled using the "Holm" *p*-value adjustment (Holm, 1979). Missing data were handled by either pairwise (descriptives) or listwise (inferential modeling) deletion.

Results

Descriptive Results

Caregiver Demographics

Table 3 shows the demographic characteristics of caregivers who responded to the FINDS survey as well as the PWIDD who they support. Inspection of the table indicates that the sample of caregivers was overwhelmingly female (83%), White (80%), and English speaking (97%). The age of caregivers varied, with 88% between 35-74 years of age. Sixty-six percent had undergraduate or graduate college degrees. Sixty percent resided in suburban areas, 22% in rural areas, and 18% in urban settings.

Persons with IDD Demographics

The demographic characteristics of PWIDD on whom respondents reported were similar to their caregivers given that most were family members. The large majority (71%) were White and English was identified as their primary language (91%). Fifty-eight percent of PWIDD were reported as male and 42% as female. As one might expect, PWIDD were younger, with 60% between 24-34 years of age. Twenty-five percent of PWIDD were reported as having a high school diploma/GED while 22% left school without receiving a degree. Although the majority of PWIDD were identified as living in suburban areas (57%), 22% resided in urban settings and another 15% lived in rural environments.

Quantitative Findings

Linear (LMM) and generalized (GLMM) mixed-effects approaches were used to determine predictors of technology access, utility, and unmet needs of PWIDD, as reported by their caregivers. Each outcome was evaluated separately for the life domains of school, employment, community, and self-determination. Technology access was continuous and was fitted with LMM. Technology utility and unmet needs were binary outcomes and modeled with GLMMs with reported estimates transformed into odds ratios. All inferential models include these predictors: (fixed, continuous) family SES, employment status of the PWIDD, level of health-related needs of the PWIDD, state-based per capita funding; (fixed, categorial) education level of the PWIDD, service accessibility, age of the family caregiver and PWIDD; (random) U.S. state of residence nested in region. For each outcome, significant results are presented within each domain (F or t-tests). For continuous predictors, fixed estimates and associated 95% confidence intervals are also reported. Descriptive summaries of post hoc pairwise comparisons are also reported for statistically significant (p < .05) categorical predictors.

Hierarchical Random Effects

U.S. region, state of residence, and per-capita Medicaid expenditures (Anderson et al., 2019) did not have meaningful or statistically significant impacts on outcomes in any domains. The intraclass correlation (ICC) for the effect of region and state was effectively zero in each model.

Technology Accessibility

Technology accessibility refers to the extent to which technology is available, easy to use, and the degree to which a person can obtain technical assistance when needed. In the education domain, caregiver SES (1.07 [1.01, 1.12], F1,2142.10=10.51, p=.001), health-related needs (.77 [.69, .87], F1,2201.92=19.45, p<.001), level of education (F6,2190.61=4.25, p<.001), and the age of the person with IDD (F8,2207.71=15.93, p<.001) were all statistically significant predictors of technology access. For level of education, those who completed 12th grade but had no diploma were reported to have lower access to technology than PWIDD with a high school (HS) diploma/GED and those with some college or a post-secondary degree. Young children with IDD between 6-13 years of age were reported by caregivers to have significantly lower access to technology than all cohorts aged 22 or older. Similarly, caregivers of the 14-21 year old cohort reported significantly less access to technology than cohorts between 22-74 years of age. Listwise deletion led to 870 (28.0%) missing cases when fitting this model.

In the employment domain, caregiver SES (1.07 [1.01, 1.12], F1,2079.79=5.71, p=.017), employment status (1.56 [1.42, 1.72], F1,2131.10=80.09, p<.001), health-related needs (.79 [.71, .87], F1,2182.95=19.46, p<.001), level of education (F6,2162.79=5.49, p<.001), service accessibility (F6,1896.88=5.19, p<.001), and the age of PWIDD (F8,2194.71=2.23, p=.023) were significant predictors of technology accessibility. Caregivers reported that individuals with IDD in 1st through 11th grade experienced lower levels of technology accessibility than those with a HS diploma/GED, some college, or a bachelor's degree. Caregivers indicated that PWIDD on waitlists for services for more than 10 years experienced lower levels of accessibility than individuals not on waitlists or on waitlists for 6-10 years. In addition, caregivers reported that individuals with IDD 55-65 years of age had significantly less accessibility than those in the 6-13 cohort. Listwise deletion led to 1080 (34.7%) missing cases when fitting this model.

In the community domain, employment status (1.64 [1.39, 1.93], F1,2166.45=35.11, p<.001), level of health-related needs (.72 [.60, .86], F1,2202.23=13.42, p<.001), education (F6,2190.17=3.07, p=.005), service accessibility (F6, 2097.36=2.68, p=.014), and the age of PWIDD (F8,2207.42=2.53, p=.010) were significant predictors of technology access. Caregivers indicated that PWIDD with a HS diploma/GED had greater access to technology than those with no diploma. Service accessibility was also found to be a meaningful predictor of technology access to technology than those not on waitlists for services for more than 10 years had significantly lower access to technology than those not on waitlists. Additionally, caregivers reported that individuals with IDD 55-65 years of age had lower levels access than those in the 6-13 and 22-34 cohorts, the difference approaching but not reaching significance (p<.06). Listwise deletion led to 871 (28.0%) missing cases when fitting this model.

In the self-determination domain, employment status of PWIDD (1.29 [1.14, 1.45], F1, 2184.56 = 16.53, p<.001), their health-related needs (.79 [.69, .91], F1,2197.82=11.68, p<.001), level of education (F6,2194.13=3.47, p=.002), service accessibility (F6,2090.91=3.87, p<.001), and age of PWIDD (F8,2200.72=2.21, p=.024) were all significant predictors of technology accessibility. Caregivers reported that PWIDD with some college had more access to technology than those who completed 12th grade but had no diploma. PWIDD on waitlists of more than 10 years had lower access than those not on waitlists, as well as on waitlist for up to 5 years. Caregivers reported that PWIDD 55-64 years of age experienced lower levels of technology

accessibility than those in the 22-34 cohort. Listwise deletion led to 878 (28.2%) missing cases when fitting this model.

Technology Utility

In the educational domain, PWIDD employment status (1.25 [1.08, 1.44], 21=9.38, p=.002), education level (26=20.25, p=.002), and age (28=64.12, p<.001) were significant predictors of technology utility. Caregivers reported that technology had greater odds of having utility for PWIDD with some college than those who completed the 12th grade without a diploma. For age, there were two trends in the data. Caregivers reported that technology had higher odds of having utility for PWIDD 6-13 years of age than older PWIDD. Caregivers of PWIDD 55-65 years of age also reported lower odds of technology utility for their family member with IDD than caregivers for the four younger cohorts. Listwise deletion led to 1,844 (59.2%) missing cases.

In the employment domain, employment status (1.46 [1.28, 1.66], 21=31.38, p<.001), education level (26=13.28, p=.039), and the age of the person with IDD (28=28.41, p<.001) were significant predictors of technology utility. For education level, no pairwise comparisons were significant after *p*-value corrections. Caregiver reports indicated that technology had significantly lower odds of utility for PWIDD 55-64 years of age compared with the 6-13, 14-21, and 22-34 (younger) cohorts. Listwise deletion led to 1,876 (60.3%) missing cases in this domain.

In the community domain, caregiver SES (1.06 [1.00, 1.12], 21=3.43, p=.064), PWIDD employment status (1.24 [1.09, 1.41], 21=10.63, p=.001), their health-related needs (1.16 [1.03, 1.32], 21=5.58, p=.018), and their age (28=23.97, p<.001) were significant or nearly significant predictors of technology utility. Caregivers of PWIDD in the 55-64 cohort reported significantly lower odds of the utility of technology than caregivers of all younger cohorts except the 0-5 age group. The number of missing cases for this domain was 1,302 (41.8%).

In the self-determination domain, PWIDD employment status (1.24 [1.09, 1.41],

21=10.43, p=.001), health-related needs (1.13 [1.00, 1.29], 21=3.53, p=.060), and age of PWIDD (28=30.02, p<.001) were significant, while age of family caregivers approached but did not reach significance (26=11.57, p=.072). Significant pairwise comparisons were only found for the age of PWIDD, where the 55-64 cohort had lower odds of technology utility than the 6-13, 14-21, 22-34, and 35-44 cohorts. There were 1,427 (45.8%) missing cases in this model.

Unmet Technology Needs

In the education domain, health-related needs (1.16 [1.02, 1.31], 21=5.48, p=.019), service accessibility (26=23.26, p<.001), and caregiver age (26=28.21, p<.001) were significant predictors of unmet technology needs. Those on waitlists for more than 10 years had higher odds of having unmet technology needs than those not currently on waitlists. Caregivers in the two cohorts between ages 25-44 reported greater unmet needs for the PWIDD they support than caregivers between 45-74 years of age. Listwise deletion led to 1,448 (46.51%) missing cases.

There were significant intercepts in the domains of employment (.04 [.003, .45], 21=6.65, p=.010), community integration (.14 [.03, .78], 21=5.05, p=.025), and self-determination (.10 [.02, .71], 21=5.35, p=.021). In the community integration domain, no effects were significant. However, in the employment domain, service accessibility (26=13.72, p=.033) and the age of PWIDD (28=17.55, p=.025) were significant predictors of unmet needs. In addition, employment (1.11 [1.02, 1.20], 21=5.78, p=.016) and service accessibility (26=12.86, p=.048) were significant predictors of unmet needs for the self-determination domain. No significant pairwise comparisons were found in either the employment or self-determination domains after correcting for multiple testing. Finally, the number of missing cases in each domain were: 1,497 (48.1%; employment), 979 (31.4%; community), and 1,106 (33.4%; self-determination).

Discussion

The purpose of this exploratory study was to better understand the associations between characteristics of caregivers and their family members with IDD and caregiver reports of technology access, utility, and unmet needs across a variety of life domains (i.e., education, employment, community integration, and self-determination). We also sought to identify whether there was an association between levels of state-based Medicaid Waiver program funding and technology accessibility, utility, and unmet needs.

A primary finding of this study is that characteristics of PWIDD, as reported by their caregivers, were more frequently significant predictors of reported technology access, utility, and unmet needs than the characteristics of caregivers. Another general result was the negligible effect U.S. region and state of residence, as well as state-based per capita Medicaid expenditures on technology access, utility, and unmet needs.

Although previous literature has discussed systemic barriers to technology access and utility (e.g., Boot et al., 2018, 2020; Khanlou et al., 2020; Raja, 2016), there is a lack of empirical literature identifying personal characteristics associated with technology access, utility, and unmet needs (Friedman, 2023). Across most quality-of-life domains, caregivers of younger individuals with IDD and those of PWIDD with higher employment status (more hours worked per week, paid at least minimum wage) and education level (e.g., having a bachelor's degree) tended to report technology as being both more available and having utility. Caregivers of youth with IDD, particularly those in secondary and higher education, tended to report having greater access to diverse types of instructional and assistive technology as part of their special education services. The association between employment status, technology access, and utility is also unsurprising, as persons with higher incomes are more likely be able to afford technology and as a result recognize its utility in various aspects of life. Finally, across most quality of life domains, being on a waiting list for HCBS for more than 10 years was associated with a lack of access to technology as well as having unmet technology needs.

Our findings align with previous research related to technology-based supports and interventions provided for PWIDD. For example, much of the research relating to supporting social skills, employment preparation, decision-making, and self-determination have been conducted in the context of secondary education and transition services with youth and young adults (e.g., Davies et al., 2018; Shogren et al., 2018, 2020; Walker et al., 2019), demonstrating that there is a focus on supporting use of technology during secondary and transition years. Less research has been conducted with respect to the utilization of technology by PWIDD during the adult years.

At the conclusion of the FINDS survey, participants were asked to respond to a series of questions regarding their need for information, training, goods, and services. Many caregivers mentioned assistive technology as one of the additional goods and services that would support not only their family member with IDD but their role as a caregiver. Caregivers viewed technology as having the potential to significantly improve the autonomy of their family member with IDD, enhance educational outcomes, and reduce the challenges associated with the direct care personnel shortage. Specific needs identified by caregivers with respect to technology included technology equipment... (such as) voice recognition software and augmentative communication devices."), and a variety of smart home/smart living technology ("for safety and emergency evacuation procedures"). Even with the availability of assistive technology, many caregivers indicated both their need and the need of the PWIDD they support for additional training and instruction on how to use technology most effectively ("The schools need to teach assistive technology before dumping a laptop on a student...None of this should fall on the

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shoulders of a family member or caregiver."). In responding to these questions, some caregivers indicated that as the advancement of technology continues to enhance the daily activities of people with disabilities, caregivers are eager to see "ways to use technology to produce training materials specific to persons with disabilities," such as "how to" video clips that persons with disabilities can watch, learn, and practice skills.

Limitations

The experiences and perceptions of caregivers come with valuable insight; however, caregiver reports may not always reflect the beliefs and perceptions of family members with IDD. Caregivers may not view or realize the value of technology as being assistive in the context of various aspects of work, at school, or in the community in the same way as their family member with IDD. Thus, it is important to consider that views about technology utility could have been quite different if individuals with IDD were responding to the same survey. Given that the analyses we conducted were secondary in nature, a primary limitation with the data analysis is the occurrence of missing data such that not all participants responded to every survey item. Crucially, some participants only responded to a selection of survey items used to address the quality-of-life domains and construct dependent variables. This resulted in sample size reductions of between 28-60% across domains.

An additional limitation to our findings is that the FINDS survey does not currently include survey items asking respondents about specific types of technology PWIDD and caregivers use. As a result, although the current study provides information about general trends in technology access, utility, and unmet needs, it does not provide context as to the specific array of technologies used by PWIDD and families. Furthermore, readers need to closely consider the impact of demographics of the participant sample on the ability to generalize findings beyond the FINDS sample. Respondents to the survey were extremely homogeneous, with the majority White, English-speaking, having a college education, and living in a suburban areas. Due to the skewness in data, we could not accurately test associations between race and the dependent outcomes, making it difficult to conclude that access, utility, and unmet needs with respect to technology are representative of the U.S. population.

The use of a secondary analysis to investigate associations between characteristics of PWIDD and technology access, utility, and unmet needs comes with limitations. In the current study, we are analyzing caregiver reports via an online survey, rather than asking PWIDD directly about their experiences with technology or testing the impact of technology use of specific quality of life outcomes. The current study therefore must be considered exploratory, producing preliminary information about technology access, utility, and unmet needs among PWIDD and providing suggestions for future research and practice, including studies that capture the perspectives of PWIDD and compare them to those of their caregivers.

Implications for future research

Understanding the challenges that PWIDD experience to accessing and using assistive technology has the potential to target specific practices and policies in need of improvement. As we consider future research with respect to technology and its impact on PWIDD, a number of recommendations can be made. This research needs to include enhanced efforts to recruit diverse cultural and linguistic communities in addition to individuals with varied support needs. Understanding how technology access, utility, and unmet needs differ across groups, especially those traditionally under-represented in research will provide better guidelines to practitioners and policy makers about approaches to providing services and better meeting needs of diverse groups of individuals with IDD. A second critical addition for future research is to gather information as to the specific reasons why different communities do not have access to technology or find it to lack utility. Another consideration is to include the perspective of paid caregivers of PWIDD, as they may have different insights than family members about technology needs and usability among PWIDD they support.

Given the increasingly critical role technology plays in all of our lives, in future editions of the FINDS survey, modifications are recommended to elicit more detailed information about and context around technology access, utility, and unmet needs of PWIDD and the caregivers. Items focused on the specific types of technology used by PWIDD, the frequency of their use, challenges with adoption are all needed. Technology lies within a spectrum of low- to high-tech (Erdem, 2017; Qahmash, 2018), and can be used in a variety of different contexts. Having more information about specific types of technology as well as how often and for what purpose they are used will provide better insight as to the types of technology needs of PWIDD. Finally, for PWIDD who do not receive government-funded services, inquiring as to whether they have access to technology through other programs, never applied for funding, or have applied and not yet received services would be of value.

Implications for future practice and policy

Technology has the capacity to enhance the independence, autonomy, and quality of life of PWIDD. Its potential has been amplified by policy changes focused on facilitating the community inclusion and self-determination of people with disabilities, including supports needed for competitive integrated employment (Wehman et al., 2018), and post-secondary education (Becht et al., 2020). Results suggest that PWIDD who are older, have greater healthrelated needs, are economically disadvantaged, and have experienced long waiting lists for services may be target populations for which provider agencies and policy makers need to explore new approaches to bridging the technology gap. Educators serving transition-aged students with IDD, for example, might consider more proactive approaches to helping students apply for services that will provide long-term technology-related supports. Self-advocacy organizations, such as the Arc, could provide similar assistance by disseminating information to support caregivers exploring how access to technology can help prepare youth with IDD for autonomy and self-determination in adult life.

Considerations for policy must address findings related to technology access. This may include increased Medicaid/HCBS funding so families can afford new technology, greater education as to how to use technology most effectively, and development efforts focused on how the principles underlying Universal Design for Learning can be applied to the adoption and use of technology to make its use more accessible, enjoyable, and useful (Devi & Sarkar, 2019). Technology has the potential to support a higher quality of life for PWIDD providing enhanced access to community living, employment, and post-secondary education, as well as being critical in supporting the exercise of their basic rights as citizens (Braddock et al., 2013; Raja, 2016). Access to technology itself is a basic human right, and there are various steps to be taken in the areas of policy and service delivery to improve the access and utility of technology for individuals with IDD who need it (Braddock et al., 2013; de Witte et al., 2018).

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Table 1

FINDS Survey Items Used to Create Composite Dependent Variables

Survey Item Number	Survey Question		
Q101 ^{a,c}	Does the person have access to technology to		
	a) Perform a job?		
	b) Do homework or other school activities?		
	c) Find or apply for a job?		
	d) Perform their job?		
	e) Stay connected to people that are important to them?		
	f) Take part in community activities?		
	g) Get where they need to go in the community?		
	h) Make choices in their personal life?		
	i) Find information or make choices about services and supports?		
Q103 ^{a,c}	Would access to technology help the person to		
	a) Perform a job?		
	b) Do homework or other school activities?		
	c) Find or apply for a job?		
	d) Perform their job?		
	e) Stay connected to people that are important to them?		
	f) Take part in community activities?		
	g) Get where they need to go in the community?		
	h) Make choices in their personal life?		
	i) Find information or make choices about services and supports?		
Q104 ^{b,c}	Is it easy for your family member to use technology to		
	a) Perform a job?		
	b) Do homework or other school activities?		
	c) Find or apply for a job?		
	d) Perform their job?		
	e) Stay connected to people that are important to them?		
	f) Take part in community activities?		
	g) Get where they need to go in the community?		
	h) Make choices in their personal life?		
	i) Find information or make choices about services and supports?		
Q105 ^c	Does the person with IDD have assistance available when needed		
`	to troubleshoot and update the device they use?		

Note. ^aResponse options are Yes/No/Not needed. ^bResponse options are Strongly

Disagree/Disagree/Agree/Strongly Agree/Not needed. ^cResponse options are Yes/No/Do not

know.

Table 2

Components of Q101 and Q103 Combined to Create Quality of Life Domain Areas

Quality of life domains	Item components
School	Attend school
	Do homework
Employment	Apply for a job
	Perform a job
Community integration	Stay connected to people
	Take part in community activities
	Get to places within the community
Self-determination	Make choices in personal lives
	Find information or make choices about services and supports

Table 3

Demographic Information of Persons with IDD and Their Caregivers

Demographic	Caregivers	Persons with IDD
Gender	Number of responses: 3,106 Female (83%) Male (13%) Non-binary (<1%)	Number of responses: 3,023 Male (58%) Female (37%) Non-binary (1%)
Race	Number of responses: 3,024 White (80%) Black/African American (5%) Hispanic/Latino (5%) More than one race (5%) Asian (2%) Race not listed (1%) Am. Indian/Alaska Native (<1%) Hawaiian/Pac. Islander (<1%)	Number of responses: 2,947 White (71%) Black/African American (7%) More than one race (7%) Hispanic/Latino (5%) Asian (1%) Race not listed (1%) Am. Indian/Alaska Native (1%) Hawaiian/Pacific Islander (<1%)
Age	Number of responses: 3,106 0 to 18 (<1%) 25 to 34 (7%) 35 to 44 (15%) 45 to 54 (22%) 55 to 64 (30%) 65 to 74 (21%) 75 or older (5%)	Number of responses: 3,027 0 to 13 (15%) 24 to 21 (23%) 22 to 34 (37%) 35 to 44 (12%) 45 or older (10%)
Primary language	Number of responses: 3,107 English (97%) Spanish (2%) Language other than listed (1%) Chinese (<1%) Tagalog (<1%) French (<1%)	Number of responses: 3,013 English (91%) Language other than listed (4%) Spanish (2%) Chinese (<1%) Tagalog (<1%) French (<1%)
Education	Number of responses: 3,103 Postgraduate degree (34%) Bachelor's degree (32%) Some college (25%) H.S. diploma/GED (8%) K– 12 th grade: no diploma (<1%)	Number of responses: 2,183 Postgraduate degree (2%) Bachelor's degree (4%) Some college (9%) H.S. diploma/GED (25%) Left K-12 without diploma (22%) 1 st grade – 11 th grade (9%)
Residence	Number of responses: 3,099 Urban (18%) Suburban (60%) Rural (22%)	Number of responses: 2,925 Urban (22%) Suburban (57%) Rural (15%)

Note. For each demographic, the number of responses to the related survey items is provided, followed by the percentage of respondents.