WHITE PAPER:

Use of Remote Support in Ohio and Emerging Technologies on the Horizon

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Ohio | Department of Developmental Disabilities

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EXECUTIVE SUMMARY

Technology influences the lives of nearly everyone in one manner or another. Most of us take technology for granted, not noticing the extent to which our everyday activities are reliant upon technological advancements and/or have been made significantly easier. In an age where every year we are more integrated into a global digital society, it is imperative that people with intellectual and developmental disabilities be included.

Technology encourages opportunities for more inclusive and independent lives for people with intellectual and developmental disabilities. Currently, approximately 90,000 people with intellectual and developmental disabilities receive supports through Ohio's developmental disabilities system. In recent years, the Ohio Department of Developmental Disabilities (DODD) has modified services in its Medicaid-funded home and community-based services (HCBS) waivers to afford people greater access to technology. In 2012, for example, a service called remote monitoring (now called remote support) was made available through the Level One, Self-Empowered Life Funding, and Individual Options Waivers. These remote support services enable people to use technology in their homes, such as monitors, sensors, communication devices, etc., through which they can receive supports from staff who are in another location.

In 2017, a mere 170 individuals were using remote support services. Through focus groups and telephone interviews, we collected responses for 56 individuals, and/or their guardians, who were either using or had previously used remote support. These individuals indicated that remote support resulted in greater independence and subsequently increased self-reported ratings of perceived safety in navigating one's environment. In fact, safety was the most frequently endorsed response among satisfaction metrics with the use of remote support.

Various new and emerging technologies may also be used to promote independence for people with intellectual and developmental disabilities. Some examples of these technologies may include: wearable technology, home automation or smart-home technologies, guided direction applications, schedule maintenance software, telehealth, robotics, augmented reality, and autonomous vehicles.

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INTRODUCTION

Increasingly, technology is impacting nearly all aspects of life for individuals living in today's society. Successful use of these technologies can greatly impact both independence and quality of life for individuals with intellectual and developmental disabilities (IDD). Technologies can present both opportunities as well as barriers to individuals with IDD. This white paper helps identify how remote support and emerging technologies have been/may be used to promote independence for people with intellectual and developmental disabilities.

Increasingly, the benefits of incorporating support technologies and remote support[1] technologies into the services and supports being provided to people with IDD are being recognized. This report provides a review of the current usage of remote support as well as use of existing and emerging technologies that are being used in the United States and internationally.

We review the use of existing and emerging technologies, including:

1. Remote support, involving the use of technology to provide in-home assistance from an engaged remote support worker who interacts with the adult with an IDD through 2-way communication.
2. The use of various technologies to promote greater independence for individuals with IDD.

Together, these supports contribute to a more self-determined life and greater independence.

DIRECT SERVICE PROVIDER WORKFORCE CRISIS

Currently, within the home health care industry there are challenges in hiring, training, and retaining people to work as direct support professionals (DSP). This is due in part to historically low wages. Nationwide, staff turnover rates for DSPs vary from 38.2% annually (Hetzler, 2016) to estimates approaching 50%. The organization *Disability Matters* presents this assessment of the effect of industry turnover rates on individuals with intellectual disability:

> *"It is estimated, for example, that even at a 40% turnover rate an adult with an intellectual disability participating in both residential and day services will receive care from as many as 164 different staff over a 10-year period. From age 18 to age 65, that translates into more than 770 different staff."*
>
> Disability Matters (2017)

[1] Remote support, also known as "Remote Monitoring." In Ohio, the service name is set to change from "remote monitoring" to "remote support" (Medicaid rule currently in process of being finalized).

Further, the number of people in America who are likely to need long term services and supports is projected to rise from 12 million in 2010 to 27 million by 2050 (ANCOR, 2014). The result is that there are not enough staff to support all individuals with needs. With the help of remote support, staffing may be distributed to those who need hands-on support. People will always be a necessary resource for in-home health care. However, in addition to person-based resources, remote support can meet a wide range of support needs, including those of people with significant physical care needs. Adoption of remote support enables provider agencies to serve more individuals without dramatically increasing staff.

Although, the national average for growth of any career position is 7%, the Bureau of Labor Statistics projects there will be a 26% increase in demand for Home Health Aides and Personal Care Aides by 2024. With a 26% increase in demand in these services, we are beginning to face what the *2017 ANCOR Workforce Report* called the "Disability Services Workforce Crisis." The report suggested that the extreme increase may be, in part, due to an increase in prevalence of autism spectrum disorder, aging caregivers, and an aging baby-boomer population. Technology can play a critical role in creating more opportunities for individuals with IDD, including helping them perform their everyday tasks and promote increased independence while requiring a lesser reliance on direct support professionals while maintaining positive outcomes *(ANCOR, 2017).* A report to the President also identified this trend in 2017. The report titled *America's Direct Support Workforce Crisis: Effects on People with Intellectual Disabilities, Families, Communities and the U.S. Economy*. This document proposed that the U.S. Department of Health and Human Services, Administration for Community Living should assist states in preparing for the workforce crisis by providing technical assistance and financial incentives to promote technology solutions in long-term supports and services, including remote monitoring (referred to in Ohio as remote support).

It is possible that remote support could contribute to lowering direct support professional (DSP) turnover rates. In Ohio, turning to the use of remote support has resulted in savings for county boards of developmental disabilities (DD) by reducing the services costs associated with having DSPs in the home. While it's possible that county boards could use these savings to reduce Ohio's waitlist, an alternative could be to use the cost savings to invest in a better work environment for DSPs by supplementing DSP wages and benefits and promoting a career path that allows for greater advancement.

REMOTE SUPPORT TECHNOLOGIES FOR COMMUNITY LIVING

Remote support services and technologies, sometimes encompassed in the term *telehealth* or *telecare*, is a newly emerging service model for individuals receiving long-term supports and services. In general, remote support technologies involve the use of home-based sensors, two-way communication systems that monitor activity, and other technologies that allow a remotely located caregiver to monitor the safety and well-being of individuals living independently. The remote caregiver can respond to identified problems via video chat, phone calls or if needed, dispatch a backup staff member to provide hands-on assistance. In this role, someone who works for a remote support vendor fulfills many of the same responsibilities of an in-home direct support professional. The main difference being that they provide this monitoring at a distance. The responsibilities of remote support staff may vary but will generally involve monitoring of conditions in an individual's home by tracking sensor data on a remote computer screen and engaging in individualized responses, in accordance with the person's individual service plan (ISP). An example might be when a bed sensor indicates that the individual has not gotten out of bed as scheduled and the remote staff places a phone call to check-in on the individual; if the phone is not answered, the remote staff would then dispatch someone to the home to address the issue, per the individual's ISP. Another example might be a remote support staff being alerted that sensors indicate that neither the refrigerator nor pantry doors have been opened since the individual arrived home, the stove and microwave have not been used, and that it is past 7:00pm—all pointing to the individual not having eaten dinner yet. Other examples might include:

- remote support staff detecting falls;
- frequent bathroom trips at night;
- open doors or windows;
- appliances being left on; or
- more complex sequences involving multiple sensors and inputs.

Remote support staff can also engage in one-on-one communication, using a video chat format to remediate situations, provide prompts, or conduct a wellness-check. These sessions may be initiated either by the caregiver or the individual with IDD. In each situation, specific instructions are available through the individual service plan to guide the remote support staff to provide a personalized and appropriate response depending on the situation in the home.

A white paper published by the Human Services Research Institute (HSRI) shed further light on the emergence of remote support in the intellectual disability service industry (see Taylor, Agosta, & Wright, 2016). The HRSI white paper offered a thoughtful narrative on remote support topics such as opportunities for use, developing a remote support service, and rate setting. Furthermore, the authors provided a concise summary of the potential for this support service in the future:

> *"State staff and policymakers seeking alternatives to traditional services would be wise to engage in conversation with states already traveling down the road of utilizing remote supports technology, and to give consideration to the many challenges and opportunities it presents. Remote supports technology has the potential to help users gain greater independence and control over their lives by reducing in-person staff presence. It may also create opportunities for providers to extend their existing workforces*

> *by providing greater flexibility as to the nature of the support provided. Furthermore, it has the potential to bring about cost savings that may allow states to offer the service more broadly, or to utilize savings to offer other services."*
>
> Taylor, Agosta, & Wright (2016; p. 5)

INITIAL RESEARCH ON REMOTE SUPPORT

Perry, Firth, Puppa, Wilson and Felce (2012) reported on findings regarding the impact on staffing levels and objective lifestyle indicators of a remote support implementation in the United Kingdom. This study included findings from 91 participants with intellectual disability. The remote support system that was deployed used an array of off-the-shelf sensors and manual alarm buttons that allowed users with IDD to summon assistance as needed. The data collected compared health indicators for those who used remote support and those who did not use remote support. Results showed that one health indicator (percentage of participants who saw a dentist) improved in those who did not use remote support, and one health indicator (slight but significant increase in Health Care Scale scores) improved following the use of remote support. There were no significant changes in the other lifestyle indicators of safety, money, social/community activity, independence or choice between the two groups. Therefore, the results suggest that significant reductions in staff presence had no adverse short-term effects on participants' quality of life.

In a pair of studies conducted by Purdue University and Texas Tech University, researchers investigated several important aspects of remote support implementation in the state of Indiana. In one study researchers used a series of survey instruments and interviews to assess perceptions of safety, security and privacy by four distinct stakeholder groups in comparing remote services with traditional staff-based supports (i.e., standard care). These groups included individuals with IDD, their volunteer advocates, administrator participants and independent case managers. Standard care was defined as current services being provided to a group of 18 individuals with IDD, and the intervention of remote support involved 27 clients using individualized remote support systems from Rest Assured, LLC, a major remote support vendor in Ohio (Brewer, Taber-Doughty, & Kubik, 2010). Results showed that all constituent groups perceived the safety, security and privacy of both approaches as highly positive (from 65% to 100%, respectively) with one exception. Only four of 11 case coordinators felt the remote support system provided a secure environment, which the authors speculate may have been related to a lack of training and awareness as this stakeholder group was the least familiar with the day-to-day circumstances of the end users with IDD. Despite this outlier, both administrators and end users with IDD rated the remote support system as providing more privacy and security than traditional services, with only the volunteer advocate group ranking traditional services as more private and secure. With respect to perceived safety, end users with IDD reported feeling safer with the remote support system than with standard staff care services, while both administrator

and volunteer perceptions favored the standard model of service provision. The authors noted that there were smaller differences between group rankings when comparing remote support and standard care support models, but that additional information suggested significant potential cost savings with remote support. The calculated cost of overnight care for staff-provided services was $69,320 per site/per year, while similar costs for remote services was $39,741 per site/per year. Therefore, it could be inferred from this study that remote support and standard care may provide similar levels of perceived safety, security, and privacy. However, remote support may be a more cost-effective approach and an appealing alternative, given current concerns with direct support personnel shortages and looming demographic factors that may only contribute to the worsening of this crisis.

Taber-Doughty, Shurr, Brewer, and Kubik (2010) published another study using this time a single-case design methodology to evaluate the effectiveness of the two-service provision approaches within a small dataset of four individuals with IDD. The comparison included on-site standard care supports provided by staff during daytime hours, and remote support service overnight. Two independent variables were measured in the study: percent of task steps accomplished independently and the duration in which the participant completed these tasks. Tasks included functionally equivalent pairs of novel household tasks attempted in the home setting. Results showed that while both types of support were similarly effective and that the four individuals varied in their independent performance of tasks. The participants performed slightly more independently when prompted by the remote support staff, with overall average independent task performance increasing by 1% to 34% under remote support. Additionally, this was accomplished with less reported prompting under the remote support condition, as onsite standard care included direct support personnel provided greater verbal (8.2%), gestural (2.6%), and physical (0.6%) prompting than did staff members via telehealth technologies, who provided only verbal prompts (6.8%) during the intervention (Taber-Doughty et al., 2010). The authors also reported that it took longer on average for the participants to complete the tasks under the remote support condition.

IMPLEMENTATION AND EVALUATION STRATEGIES

Early adopter states of remote support services have developed rigorous requirements and procedures for assessment, consent, implementation and evaluation of remote support equipment and services. Typical elements of these regulations include but are not limited to:

- An assessment process to determine situational appropriateness and potential benefit;
- An informed consent process by all residents in a living environment who may be affected by the service/equipment;
- Requirements for backup power systems;
- Emergency backup procedures;

- Two-way on-demand or resident-initiated communication system between resident and remote support staff;
- Specific provisions outlining the limits of using video *surveillance* technologies;
- HIPPA compliance;
- Visual or other indicator that allows the resident to know when remote support systems are activated;
- Person-specific response protocols (e.g., 'response tree') to address needs/issues identified by the system, to include deployment of stand-by staff if needed;
- Specific limits on when the technology can be used and when it cannot be used;
- Ongoing periodic reviews of appropriateness, efficacy, unintended consequences, etc.

STATE OF REMOTE SUPPORT USE AROUND THE UNITED STATES

Ohio is not the only state interested in using services similar to remote support to promote independence for people with intellectual and developmental disabilities. Other states with similar services include Indiana, Minnesota, South Dakota, Tennessee and Wisconsin. While there may be some differences in service or title, the general concept remains the same: the use of technology to connect someone to a caregiver who is providing support from a distance. Generally, these services are provided through state Medicaid DD Waivers.

Minnesota is one example. In Minnesota a service referred to as "*monitoring technology supervision*" is similar to remote support in Ohio. Minnesota Department of Human Services (DHS) defines monitoring technology supervision as "*The use of equipment to oversee, monitor and supervise someone who receives waiver... services [including DD waiver services]. It can help keep people safe and support independence. The equipment used may include alarms, sensors, cameras and other devices*."

Minnesota requires an extensive approval process before a waiver will pay for monitoring technology. Environmental Accessibility Adaptions will pay for an assessment to determine the person's eligibility for monitoring technology supervision. After an assessment has determined an individual is eligible for the service, the lead agency must approve the monitoring technology. Then, before an individual may start the service, they must complete a "*Participant Consent for the Use of Monitoring Technology*" form. This is a form designed to ensure that each individual receiving services understands their rights and the service they are signing up for. The applicant must identify where the technology will be in the home, what the goals and outcome will be of the monitoring technology, the times the technology will be in use, what any alternative options for services would be, what information will be collected by the monitoring technology supervision workers, who will have access to the technology, and how to stop the use of monitoring technology supervision services. Lastly, the lead agency oversees and re-evaluates the documentation in the support plan, annually. The lead agency reviews the monitoring technology in use as well as the progress made toward the identified goal (Minnesota DHS, 2018).

Indiana is another example of a state with a service similar to Ohio's remote support. In Indiana, the service is called "*electronic monitoring/surveillance system and on-site response*". However, it is commonly shortened to electronic monitoring. Available to adults using a Community Integration and Habilitation (CIH) Waiver, electronic monitoring is defined as "*The provision of oversight and monitoring within the residential setting of adult waiver participants through off-site electronic surveillance. Also included is the provision of stand-by intervention staff prepared for prompt engagement with the participants and/or immediate deployment to the residential setting*."

Individuals who request electronic monitoring must be assessed by the Individual Support Team (IST) to ensure the service is appropriate for meeting the health and welfare needs of the individual and have written approval by the provider's human rights committees (HRC). Further, these activities are documented and retained in the Individual Service Plan (ISP) as well as the Division of Disability and Rehabilitative Services (DDRS) Case Management system. Annually, assessments must be performed by the IST to determine that the electronic monitoring system will ensure the health and welfare of the individual. Also, every 90 days, the appropriateness of continued use of the monitoring system must be reviewed by the IST.

Despite having detailed documentation, sometimes problems occur in the coordination of roles. In order to ensure that each party is prepared in the event of an emergency, the Indiana rule requires that emergency response drills be carried out once per quarter across all three shifts in each home with electronic monitoring equipment (Division of Disability and Rehabilitative Services, 2016).

ETHICAL AND SAFETY CONSIDERATIONS

Ethical and safety issues also need to be resolved in the evolution of remote support. The use of surveillance video cameras appears to be of particular concern. For example, some states with emerging remote support programs only allow cameras to be used in common-areas such as kitchens or entry ways and require alerting visitors that cameras are in use. With the advent of YouTube, combined with the high rates of DSP turnover in the IDD service industry, parents and advocates have expressed concern over captured surveillance video ending up on the internet, especially with some states requiring data retention for up to seven years (Davis & Wellems, 2011). Compliance with the Health Insurance Portability and Accountability Act (HIPAA) also has far reaching implications for remote support systems. As with any new intervention for what is generally considered a vulnerable population, human rights questions have also surfaced. While states such as Missouri require case-by-case approval from local Human Rights Committees, other advocates have suggested that the use of remote support should be solely up to the individual receiving services and his/her family, claiming that requirements for human rights review are, in effect, a violation of their human rights. In another example of how human rights issues are being addressed, Ohio views it as one's right to consider the less intrusive option of remote support services before considering homemaker/personal care services. The Ohio rule indicates that remote support is intended to address an individual's assessed needs in a manner that promotes personal autonomy and minimizes dependence on paid support staff, and that remote support should be explored prior to authorizing service categories that might be more intrusive (e.g., homemaker, personal care).

Yet another issue relates to the fact that many potential consumers of remote support services live with one or more roommates, thus potentially affecting their privacy and service provision as well. While this can be addressed through policies requiring informed consent for all individuals living within a shared environment, the momentum for including this type of service provision is clearly going to continue and these issues will be resolved through ongoing establishment of best practices based upon measured implementations.

DIGNITY OF RISK

Human contact and interpersonal relationships are critical aspects of caregiving. The goal of remote support is not to replace them. It is critical to maximize the use of technology to support people where appropriate. In doing so, the likelihood that people with the greatest needs will have access to DSPs to provide care should increase.

Dignity of risk means that someone is viewed with honor and respect to the extent that they are trusted to make decisions that may result in negative consequences that could have been avoided had an individual been less self-reliant. It is important to acknowledge that promoting self-determination and personal independence provide opportunities for an individual to take on more risk, no differently than their same-age typical peers.

Similarly, promoting self-reliance can be viewed as promoting opportunities to be challenged, learning new skills and recognizing potential. Earlier in this paper, a study was referenced that compared task completion of individuals using remote support to individuals who were not using remote support. Task completion, while in the physical presence of a person providing prompts, was found to promote a similar (if not worse) task completion rate when compared to not having the physical presence of staff member (Taber-Doughty, Shurr, Brewer, & Kubik, 2010). While these tasks may have taken a longer time to accomplish for those who were prompted remotely, the tasks were able to be completed independent of having staff physically present in the home.

Technology provides tools for living with greater ease, connecting with people more frequently; and creating opportunities to accomplish things that would have been oftentimes, impossible otherwise. Technology has the potential to support people with intellectual and developmental disabilities to live more independent and socially-engaged lives. However, a potential risk associated with increased independence in the home is greater isolation. There is a legitimate concern that individuals with intellectual and developmental disabilities would be further disenfranchised from their communities by incorporating technologies that, by design, might in some situation promote less community access and interaction. However, while some technologies such as a grocery delivery application or telehealth may inadvertently promote staying home – there are other clear benefits and gains. Through accessible social applications, the use of wearable technology and autonomous vehicles community access could also be promoted.

RESPONDENTS' EXPERIENCE AND SATISFACTION WITH REMOTE SUPPORT

FOCUS GROUPS AND TELEPHONE INTERVIEWS

Before conducting our focus groups and telephone interviews, the first two authors of this White Paper held a series of preliminary group discussions with self-advocates and parents/guardians of sons/daughters of transition-age, to learn about their knowledge and experience with remote support and other technologies. With each of these groups, the concept of remote support was explained then the participants were asked what they thought they might like and dislike about remote support. The responses from these discussions helped develop questions for the focus groups and telephone interviews.

The self-advocates reported that they liked that the service might contribute to independence (including: a reduction in the need for staff presence as well as promote greater personal autonomy), provide increased in-home safety, and make supports available even when staff are not present. The respondents also indicated that they perceived remote support as infringing on their "privacy," contributing to reduced social interactions, and associated with more risk than having in-home staff.

The parents reported that they liked that the technology had the potential to be less invasive than cameras but, overall, their immediate response to remote support was somewhat negative. They indicated that they perceived remote support as being more intrusive on one's privacy, had concerns regarding the technology's susceptibility to hacking, worried that the complexity of the technology might make the service/equipment inaccessible for their son/daughter to use, and had some individual concerns about the service being able to meet the specific needs of their son/daughter.

When the adults with intellectual and developmental disabilities, who were currently using or had previously used remote support and their guardians were interviewed, they reported fewer concerns about privacy and had a more positive attitude towards the technology. In the experience of many people who participated in focus groups and telephone interviews about remote support, the use of the service reportedly resulted in greater independence and in a safe and healthy environment. While there were concerns presented about privacy and some cases of malfunctioning technology, the overall responses from the participants were positive. Reports also indicated that remote support had provided some participants with the ability to make extreme changes in their lives, for the better.

Participants were asked a series of open-ended questions[2] in a conversational format, separated into themes and overlapping topics. Three separate focus groups were conducted with a total of 12 participants. An additional 44 participants were asked the same questions via one-on-one telephone interviews[3], for a total of 56 respondents.

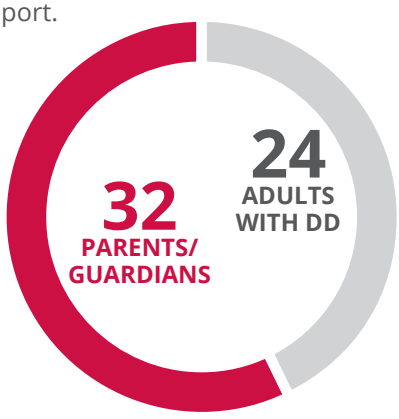
DEMOGRAPHIC INFORMATION

Respondents

The results summarized herein include responses from a total of **56 participants** ranging in age from 21 – 74 years (mean = 41.3 years; standard deviation = 14.5 years).

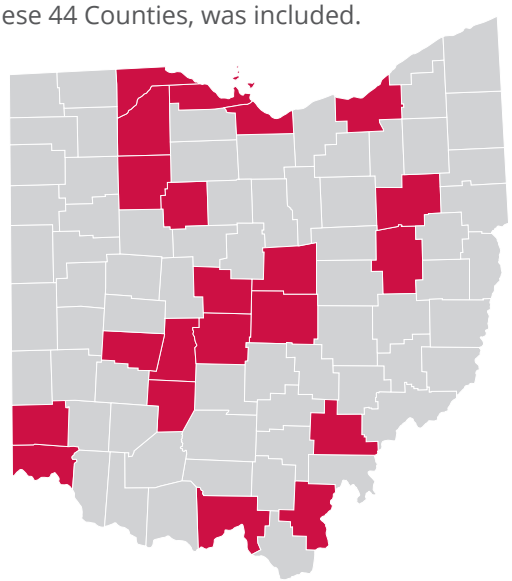
Participants

In all, there were 56 participants. Twenty-four (24) respondents were adults with intellectual and developmental disabilities who either currently used or had previously used remote support and the other 32 respondents were parents/guardians of adults with IDD who currently used or had previously used remote support.



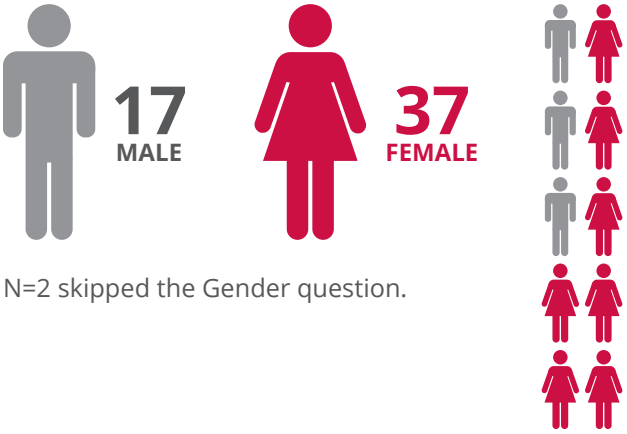
Ohio Counties

Of the 88 Ohio counties, 44 counties had at least one individual who used remote support. In the focus groups and telephone interviews, at least one respondent from 21 of these 44 Counties, was included.



[2] Questions available in Appendix A
[3] See appendix B for questions used in the telephone survey

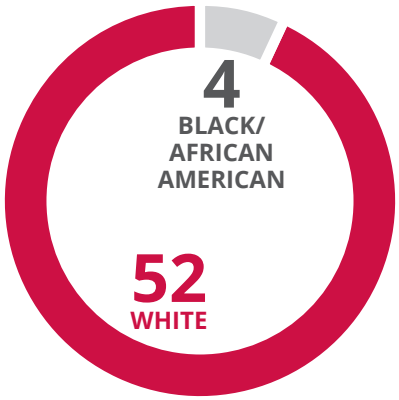
Gender



N=2 skipped the Gender question.

Race

The race distribution of our group of participants consisted of 52 White/Caucasians and 4 Black/African Americans.



DD Waiver Type

Thirty-two (32) respondents reported using the Individual Options (IO) Waiver services and only 2 respondents reported using Level One Waiver services. This question was skipped by 22 respondents.

Living Arrangement

Twenty-eight (28) respondents lived alone and 21 respondents lived with at least one roommate. Seven respondents omitted to respond to this question.

Use of Remote Support Services

The duration of use of remote support for those who responded to this question (i.e., n=49) ranged from < 1 year to more than 5 years. Two-thirds of respondents (35 of 49) had been using remote support services for 2 years or less. Forty (40) respondents reported they were currently using remote support; whereas, nine respondents had previously used remote support but were no longer using remote support at the time of the focus group or telephone interview.

COMPARISON OF OUR SAMPLE TO THE LARGER POOL OF USERS

While there are currently 270 individuals who use a Medicaid funded Home and Community-Based Services (HCBS) waiver to pay for remote support in Ohio, there have been a total of 356 individuals who have billed for remote support at some point in time. The demographics of those who have billed for remote support over the course of its availability (n=356)

contrast slightly from the demographics of those who participated in our focus groups and telephone interviews (n=56), except for the proportion of individuals using remote support who are on the I/O waiver. The charts below depict the comparison between the demographics of these two groups of individuals.

Gender

	All Remote Support Users	Focus Group/Survey Participants
Total	356	56
Male	201/355 (57%)	16/52 (31%)
Female	154/355 (43%)	36/52 (69%)
Unknown	1	4

Race

	All Remote Support Users	Focus Group/Survey Participants
Total	356	56
White/Caucasian	283/333 (85%)	47/51 (92%)
Black/African American	43/333 (13%)	4/51 (8%)
American Indian/ Alaskan Native	5/333 (2%)	0/51 (0%)
Asian	2/333 (1%)	0/51 (0%)
Unknown	23	5

DD Waiver Type

	All Remote Support Users	Focus Group/Survey Participants
Total	356	56
I/O	309/331 (93%)	32/34 (94%)
Level 1	13/331 (4%)	2/34 (6%)
S.E.L.F.	9/331 (3%)	0/34 (0%)
Not reported/Unknown	25	21

QUESTIONS ASKED

During the focus groups and telephone interviews respondents were asked a series of questions about their experience and satisfaction with remote support. Each question was open ended and the responses were categorized into themes. The total percentage of responses for each question does not always equate to 100% because many participants were permitted to endorse more than one response.

How Did You Learn About Remote Support?

When asked where (or from whom) the respondents first heard of remote support, 19 of the 50 adults with intellectual and developmental disabilities who currently used or previously used remote support and/or their parents/guardians reported having learned of remote support from their SSA. The second most common response was family/friend/guardian (11 respondents).

Did You Use a Backup Support Person?

Findings showed that 23 of 40 respondents reported having used backup services at some point in time while using remote support.

The most common reason mentioned for accessing backup support services was: power outage. Other reasons for using backup supports services were: injuries, voluntarily rejecting remote support, taking medications, and illness. One respondent explained: "*They called us as the backup people. Alright, that's the way they work. There are backup people. And so, that time he did not end up in the hospital...*" Many participants shared their stories about their experience with emergency backup. In one instance, an individual using remote support let someone in the house in the middle of the night and the remote support staff were able to identify this situation and immediately sent a backup support staff member to the home. Another participant had hurt his foot and it was bleeding. The remote support staff tried to talk him through addressing his injury but he was unable to stop the bleeding. Eventually, the individual's grandmother stopped by the home and took him to the hospital to get stitches. In another incident, the fire department was contacted because the oven began to smoke while the adult with IDD was cooking a pizza.

What Do You Like About Remote Support?

Safety was the number one benefit endorsed by users of remote support, with 35 of 53 respondents endorsing this response choice. Participants also indicated that, with remote support: they felt safe, were less worried about a break in, and/or had confidence that they would have adequate support during an emergency such as a fire.

Approximately half of the respondents (26 of 53) reported that increased independence was another benefit that they liked most about using remote support.

> *"Having remote support is like having a personal body guard."*
>
> - Adult who uses remote support

> *"[remote support has] really helped him being able to have some of that private time with his girlfriend without it just being really awkward."*
>
> - Guardian

Twenty (20) respondents identified the presence of a remote support staff as something that they liked about their remote support services. As an example, one of the respondents had strangers coming to her house in the middle of the night, knocking on the doors and windows. She would call her remote support worker and ask them what to do and they helped her through these scary situations.

> *"It helps me with my health... in case I fall... or have seizures or something..."*
>
> - Adult who uses remote support

The health aspect (e.g., medication reminders) was another benefit reported by participants regarding their experience with remote support and was endorsed by 16 of 56 respondents.

The table below presents the responses of each of the two groups of respondents (adult with IDD and Parent/guardian) to the question: ***What do you like about remote support?***

	Adults with DD* (N=22)	Parents/Guardians** (N=31)
Safety	14/22	17/31
Independence	6/22	20/31
Remote Support Staff	11/22	9/31
Health	6/22	10/31

Note: Three respondents chose to not respond to this question.

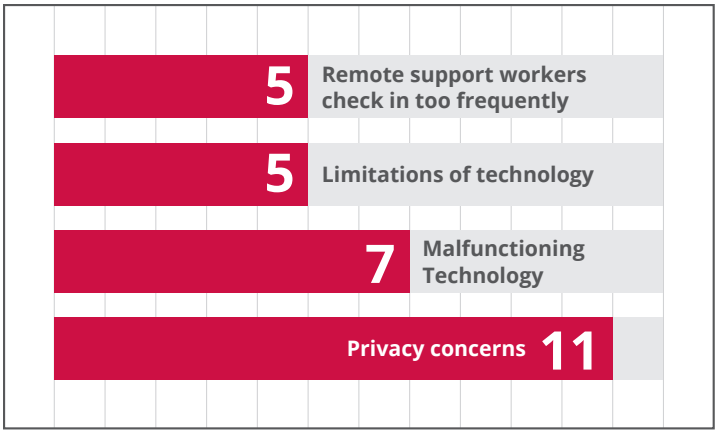
*** Adults with DD:** "Safety" was #1, followed by "remote support staff".

**** Parents/Guardians:** "Independence" was #1, followed closely by "Safety".

Safety remained the most frequently endorsed response by adults with intellectual and developmental disabilities regarding their experience with remote support. The second most important factor endorsed was their affinity for the remote support staff.

It is noteworthy that half of adults with intellectual and developmental disabilities, who were either currently using or had previously used remote support, reported that remote support staff was something that they liked most about remote support. The group of adults with IDD using remote support reported being initially concerned that they would be less socially engaged because of the resulting reduction in staff hours and that they would miss out on time with trusted caregivers. However, interactions with the support staff remained something that respondents liked about their remote support services. During one focus group, two adults with IDD who had stopped their use of remote support were asked what they liked about the service when they had it. Both respondents said they liked their remote support staff. One of the respondents said he missed his former remote support workers.

What do you NOT like about remote support?



11 of 56 respondents reported privacy concerns.

> *"I don't want to be on camera all the time."*
>
> - Adult who uses remote support

When asked "***What do you NOT like about remote support?***" 11 respondents endorsed **"privacy"** as one concern they had with remote support. One respondent said she felt like she was being "babysat in [her] own house." Sometimes, if she went out the door or opened a window, the remote support staff would call her on the communication system.

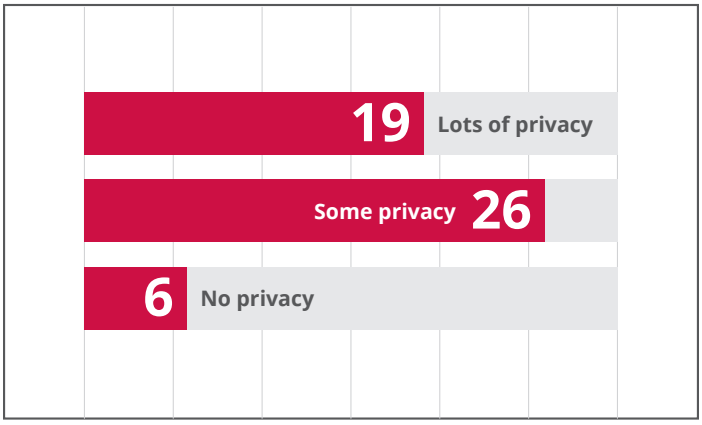
With seven responses, malfunctioning technology was the second most commonly endorsed aspect of remote support that participants disliked. There were other more isolated responses given by the respondents. One respondent said that the technology occasionally "*gets screwed up*". When this happens, the caregiver was asked to fix the technology under the direction of the remote support vendor. The remote support vendor lived far away. Therefore, if there was a major issue, it could take several days before the problem was fixed.

Some respondents said they had a problem organizing backup. One of these respondents said they had 3 different providers because some providers did not provide backup support and others were not able to provide the backup support staff. She continued to say: "*I think [the different providers] get a little confused about what their role should maybe be…We've tried to outline [specific roles] in the ISP and make it a little bit more clear*." This issue was resolved, but it took some effort for all parties to be on the same page.

It is intriguing to note that 11 respondents reported having privacy concerns with the use of remote support. However, when asked ***"How much privacy do you feel you have in the home?"*** - 45 of 51 respondents reported they either felt "*some privacy*" or "*lots of privacy*" in their home. Only 6 of the 51 respondents reported they had "***no privacy***."

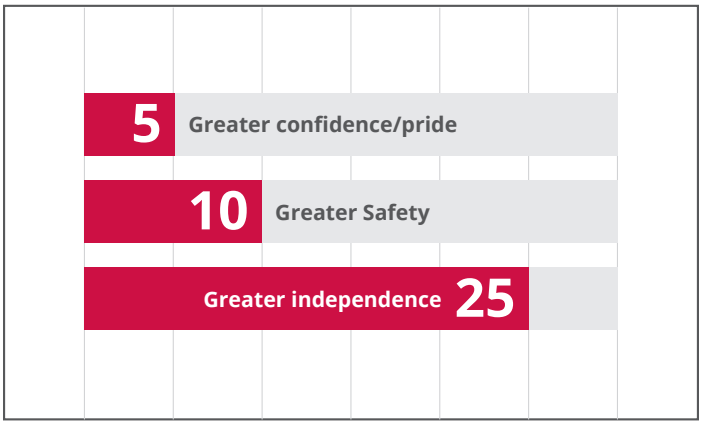
> *"[Remote Support] provided us more privacy than we've ever had with providers."*
>
> - Mother

How much privacy do you feel you have in the home?



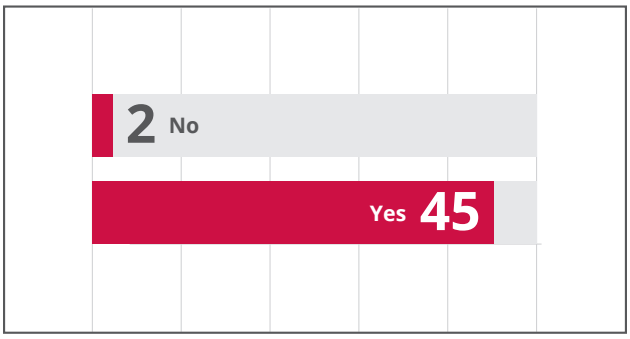
Nearly 9 out of 10 respondents reported feeling "some" or "lots" of privacy in their home

How is your life different since using remote support?



25 of 35 respondents said that, since they started using remote support, they have experienced greater independence.

Would You Recommend Remote support?



Lastly, the results showed that more than 45 out of 56 respondents reported that they ***would recommend*** remote support to a friend.

STORIES FROM THE FOCUS GROUP DISCUSSIONS

Nearly half of the respondents (26 of 53) reported that increased independence was an important benefit that they had experienced as a result of using remote support.

One respondent, a guardian from an advocacy and protective services agency, reported providing guardianship services for two individuals who had experience using remote support. Names have been changed for the following story. These individuals will be referred to as Jane and Eric. Jane had been using remote support and the other, Eric, had quit using remote support at the time of the interview. Both had a similar response to the service.

Jane and her team wanted her to pursue remote support because they thought it would promote a greater independence and permit better in-home supervision. Jane had difficulty being at home by herself. Not having someone in the home, initially caused anxiety for Jane. When alone, Jane would often call her direct support staff, friends or family, asking someone to come over to the house. Remote support was chosen as an alternative to having staff in the home during a small block of hours. After using remote support for a period of time, being alone no longer caused anxiety and Jane was able to be alone time for increasingly longer periods of time. Other changes included Jane taking more initiative to clean her home without needing prompting from staff.

Eric had 24-hour staffing and he would often become physically aggressive with his staff. The team decided to try remote support. As the hours with staff decreased, the frequency of Eric's aggressive behavior also declined. Today, Eric no longer needs constant 24/7 support staff, remote support or otherwise. Now, Eric only needs occasional drop-in staff. Meaning, Eric only needs people to come to the home to assist him on an as-needed basis. Remote support provided a safe environment to provide support without having staff in the home. This freedom enabled Eric's needs to be reevaluated and assisted him as he transitioned to have drop-in staff rather than 24-hour support.

The respondent reported that remote support enabled Jane and Eric to become more comfortable living with greater self-reliance, during times without the physical presence of DSP.

The following report is one example of how remote support has resulted in a substantial change for some individuals. When Carol and Howard reached their 50s, they had a conversation about the need to plan ahead for their son Christopher (Chris). Realizing they wouldn't be able to take care of Chris his entire life, they began to consider ways in which they might prepare Chris to live more independently and provide him with support as he sought to achieve his goals for independence. They were prepared when Chris came to them and said: "*I'm an adult and I need to move out*." In order to assist Chris in meeting this goal, his parents converted an attached garage into an apartment in which Chris was able to live. It was in this setting that Chris first tried the use of remote support. After being successful in this living situation, Chris found a 2-bedroom apartment with an attached garage (for his John Deere lawn mower) which he found suitable to make his home and continued using remote support services in his new home. Chris needs support with time and money concepts and he also has a health condition that impacts his living functioning that requires some support.

When Chris has a fever, it might be an indication that he is having serious liver difficulties. While Chris does take his own temperature three times a day and shows the results to a remote support worker via an in-home camera, the remote support staff are also trained to identify other signs that Chris might be starting a fever. Once, a worker recorded Chris' temperature and, when it was determined he had a fever, the backup support was called. They were able to assist him before it escalated. In this situation, the fever was a sign of the flu rather than a liver incident. But, the event solidified that, if there was an incident involving liver problems, the protocol in place seemed to work. In Carol's own words, she said "*Our initial [thought] was: Are they going to be able to do everything that we would like them to be able to do, for us to feel confident enough that Christopher is going to be safe? There isn't a doubt, in our minds, that he is safe.*" Without the use of remote support, Chris would not be able to live independently. Howard and Carol feel secure, knowing that their son is safe.

With 35 of 53 respondents endorsed "Safety" as what they liked most about remote support. During one focus group, Carol made it clear that safety was an important factor in the success of remote support for Chris. Below is an excerpt from an Email that she sent to the first author after the focus group:

> *"We believe that people with disabilities have the right to accept challenges in the pursuit of developing independence and reaching their potential, whatever that might be. As parents, it is our job to make sure that taking on those challenges doesn't happen at the price of safety. Remote monitoring provides a level of safety that allows for meeting the challenges that they accept (e.g., One of Christopher's goals was to "move into his own place someday"). I can say definitively that without remote monitoring, Christopher's goal would not have been reached, and achieving that goal is essential to the promotion of self-reliance. Safety is a responsibility of parents/guardians who are supporting and guiding them to the self-reliance they are going toward. Safety must be in place in order for self-reliance to develop."*
>
> - Christopher's mother

CONCLUSIONS

Through the use of focus groups and telephone interviews we collected responses regarding 56 individuals who either currently use, or previously used remote support and their guardians. In the experience of many people who participated in the focus groups and phone interviews, using remote support resulted in greater independence in a safe environment. One respondent describes their experience with remote support as "like having your own personal body guard." Safety is an important aspect of increasing independence. One parent explained in an Email that if remote support did not provide a reasonable level of safety, they never could have taken the risk to pursue the level of independence that her son now has.

For some respondents, independence may mean taking on new responsibilities, for others it may mean getting a full night's rest without having staff in the home. It's clear that individuals who use remote support have experienced change on many different levels. Whatever the change may be, remote support is enabling many Ohioans with intellectual and developmental disabilities to lead lives they want in the least intrusive manner for them. The examples provided throughout this study have shown that sometimes reducing staff presence in the home may benefit independence and reduce challenging behaviors while still ensuring safety.

Though there were concerns about privacy, a majority of respondents reported feeling "some" to "a lot" of privacy in their home. In fact, one mother claimed that remote support provides more privacy than her son ever experienced with providers. One respondent reported that one characteristic about remote support that was not liked was that it afforded *too much* privacy.

More than 9 out of 10 respondents would recommend remote support to someone else. This service comes highly recommended by those who have experience with the service. This information should propel remote support uptake throughout Ohio.

Benefits of Remote Support Technologies

While people with IDD, their families, service providers and funding entities begin discovering and working through initial adjustments to using remote support services, the current momentum of remote support as an industry service model is being fueled by the potential of its positive benefits. As has been briefly discussed, after considering issues of safety and how it can increase individual choice and independence, consideration should be given to the potential benefits of its cost-effective provision of services to individuals for whom remote support may be appropriate. Given different approaches across states regarding funding of long-term supports and services, real world data on the cost effectiveness of remote support continues to be collected as an increasing number of state and provider agencies begin to make remote support services available. This movement will also likely result in adjustments to funding and remote support provision approaches. It will also be important to study what happens to cost savings that may occur in terms of who benefits (states, funding agencies, service agencies, individuals with IDD) and what is done with any savings. States may opt to retain any savings realized from remote support efficiencies to obtain fiscal relief, to control increases in Medicaid costs, or to provide addition waiver services for more individuals who may be waiting for services. Other states may return the savings back to county boards or service providers who could use these funds to support increased wages and benefits for direct support professionals or to otherwise enhance service provision.

As previously mentioned, there is some evidence indicating that the use of remote support may reduce the need for direct support professionals in the home, which may at times unintentionally promote dependence more than independence (McKenzie & Macleod, 2012; Vorhaus, 2007). In these cases, efforts should be made to assure that those who provide in-person support are providing it in a manner that minimizes the need for individuals receiving services to engage in behavior to gain more staff attention.

When well planned, the reduction in physical presence of staff in the home should promote increased independence in the performance of tasks of daily living for individuals using remote support. This might be countered by concerns regarding less social contact and possible increased loneliness. While these concerns have validity, they may be proactively addressed by ensuring that agency staff contacts continue with more of a focus on high-quality socialization activities that could increase opportunities for interpersonal interactions and communication, positive social skills practice and social engagement. Instead of having staff do the laundry, clean or cook for the individual, the staff resources could be better allocated to be focused on increasing desired social engagement, community activities (e.g., using cost savings to purchase YMCA or similar memberships or adult day program services, going bowling or engaging in other community-based hobbies, or to attend desirable social events or join community social clubs), and other ISP goals staff may often not have enough time to support.

There are numerous other areas where research-based evidence is being collected to assess the potential benefit of remote support technologies. These include the impact of remote support on quality of life, self-determination, health and safety issues, behavioral health, social impacts on the provider/customer relationship, and technology failures and fail-safe system backups. As the remote support industry matures, the availability of experience-based evidence will help clarify concerns and challenges regarding its use and may help identify strategies, technologies and solutions that could result in additional benefits to be realized by all stakeholders.

OTHER EXISTING TECHNOLOGIES

After years of being largely ignored by the rehabilitation and assistive technology field, the needs of people with IDD are finally being addressed by technology innovators. As a result, this field has grown organically over the past two decades through a convergence of research and development activities that have focused on meeting the needs of various groups of people (i.e., people with intellectual and developmental disabilities, traumatic brain injury, dementia, etc.), people may often have very similar support needs to address impairments in memory, abstract thinking, executive functioning, task sequencing, motor, and/or adaptive behavior. There are 28 million people in the U.S. with some form of cognitive disability (Coleman Institute for Cognitive Disabilities, 2013). The field of remote support has evolved through predictable stages beginning with research and preliminary testing of prototype technologies, to the development of commercially available technologies for consumers, culminating in the implementation and adoption of these technologies into the everyday lives of individuals with cognitive disabilities. However, as is common with the evolution of any new field, there are barriers that must be overcome at each transition point.

HOME AUTOMATION

Since the early 1900s technology has been replacing activities and chores around the home. This includes such things as sewing clothes, washing clothes, washing dishes, storing and cooking food, bathing, etc. Not quite ubiquitous yet, "*smart home*" is a term that refers to a home that uses connected technology to control appliances and the home environment (e.g., heating/cooling, lighting, home security) and is often associated with energy efficiency.

Home automation incorporates devices that may benefit an individual with intellectual and developmental disabilities in many ways, including: assisting with decision-making (e.g., helping with meal preparation, moderating temperature, deciding what to include on a grocery list); moderating resources such as water and electricity; and identifying and mitigating danger within a home (e.g., timed locking of doors, turning off appliances, flood detection).

Decision-making is one of the ways that a *smart home* may be able to benefit those using the technology. One such example is the *Nest Thermostat*. This device identifies one's typical thermostat usage and changes the temperature automatically based on the identified pattern. For example, if a person's preference is to have the in-home temperature be low at night but warmer during the day or if another person doesn't like the air conditioning to be active when they're not at home, the *Nest Thermostat* can seamlessly accommodate those preferences. Another example includes a device called the *Fridgecam*. This device, made by a company named *Smarter,* is simply designed. It places a camera in the refrigerator that allows the contents of the refrigerator to be viewed remotely using a cell phone. The *Fridgecam* catalogues the items in the fridge and helps to keep track of the expiration dates and inventory of essential items. This could assist people with intellectual and developmental disabilities recognize when food needs to be eaten before it expires but also, when food may need to be thrown away and avoid potential food poisoning. The device can also be used to help prepare a shopping list.

If combined with a grocery delivery application, the *Fridgecam* could help to construct a list of foods to order and have delivered to the home. One such application grocery delivery app is *instacart*. Using this application, a customer may have groceries delivered from different vendors across Ohio (e.g., Kroger, Meijer, Fresh Tyme). The company will also deliver items from other stores such as Petco and CVS pharmacy. This could reduce the amount of staff time required for transportation to and from grocery stores, ensure timely delivery of medication and could allow the individual and/or

staff to focus more time on other activities. If grocery delivery was incorporated into services, it would not necessarily be used universally. Many individuals may want to go to the grocery store because they view it as a social activity. Therefore, while something like this may promote independence for some, it might result in an unintentional reduction in social engagement for others. Ultimately, these decisions are made by the person and the people that support her/him and their personal specifications and preferences should be included in the person's ISP.

Home automation is useful, in part because of its ability to communicate from one device to another. *If This, Then That* (IFTTT) is a software or app that controls electronics in the home using "recipes." A *recipe* tells a device to accomplish specific tasks based on preset parameters. This feature could be used to help with moderating resources. For example, if the thermostat rises above 73ºF then the ceiling fans could be activated. Having a preset *recipe* like this may help moderate the electricity usage in one's home. Smart phones are typically equipped with geo-fencing features. Using various sensors, the technology in your home can tell when you leave the house and even when you are returning. Using the IFTTT app and your phone's geo-fencing (i.e., using the GPS feature in a smart device to signal another device that you are in proximity) capabilities you can program specific electronics in your home to power up when you (or your smart phone rather) are within a specific distance from the home (e.g., within 100 yards of your house). One example for how this could be used is for people who struggle with using a key, their smart phone device can be used to electronically lock or unlock the door to their home, turn on/off lights, etc.

The ability to mitigate danger may, arguably, be the most important aspect to the growing capabilities of home automation and the creation of *Smart Homes*. For example, some adults with intellectual and developmental disabilities can have trouble identifying when temperatures are too hot or too cold. By setting the shower to automatically reach specific temperatures, this danger can be reduced. With the use of recipes from IFTTT the power could be turned off to the stovetop if the person's *smart watch* or *smart phone* disconnects from the house's Wi-Fi or by using geo-fencing features that can register the device as being a specified distance from the home. This means that if an individual accidentally leaves the stove or oven on when they leave the home, the stove/oven could automatically be shut off. Another example of how IFTTT could be used includes, reducing the number of falls and injuries by automatically turning on a light at night. The system could be programmed with a bed sensor to turn certain lights on upon getting out of bed. A voice activated device could also serve to call for help, including dialing 911.

COMMUNITY CONNECTIONS SOFTWARE

As previously mentioned, technology has the potential to inadvertently promote isolation. While home automation or telehealth (which will be discussed later) can encourage people to not leave the home, these technologies are designed to reduce the barriers to greater community access and availability. Many applications exist which assist people to access the activities they seek to do in the community. For example, applications which provide a geographically based list of activities can encourage people to get out into the community and find an event that is nearby. These smart devices can also provide the individual with personalized step-by-step directions (e.g., walking, using a car or public transportation) to get to the event location. People could use the internet to discover events in their own neighborhood or around the world.

For many, this is how they discover ways to be more involved in their community and they do not have difficulty finding these events using an internet-based search app. However, if there is too much content on a webpage or it does not meet accessibility guidelines then accessing the information could prove to be difficult or frustrating for individuals with intellectual and developmental disabilities.

Facebook is one tool that has become an increasingly popular platform to access social media and connect with friends/family or find a local event. *AbleLink* developed a program that would make Facebook more cognitively accessible to individuals with intellectual and developmental disabilities. This platform is called *Endeavor Connect*. A study conducted in 2015 investigated the effectiveness of using this specific overlay. According to the study, results suggested that "*when using Endeavor Connect, young adults with intellectual disability completed more tasks independently with fewer errors and required fewer prompts*" (Davies, Stock, King, Brown, Wehmeyer, & Shogren, 2015).

SMART WATCHES/DEVICES

Wearable technologies have become a popular category for consumer electronics and are anticipated to increase in production. Technology can be found that incorporates the design and utility of clothing or jewelry. While many of these technologies may help make simple tasks simpler – like adding gesture controls to one's jacket sleeve to answer a phone call, play the next track, or update someone about their estimated time of arrival at a destination (e.g., doctor's office, or work) – many of these technologies are being designed in a way that support healthy living (e.g., medication reminders, preemptively identifying potential health problems, or monitoring exercise and calorie intake) and promote independence. Some features may be especially helpful with promoting independence for individuals with intellectual and developmental disabilities.

Smart watches get their name from their watch-like design but these devices go well beyond traditional telling time-and-date functions. *Smart watches* operate more like smartphones with a small but always-available touchscreen and include a wide range of specialized software applications. They may also include a variety of other functions such as vibration or monitoring personal vital signs. *Smart watches* generally include the ability to synchronize with a *smart phone* but are increasingly being equipped with stand-alone app capabilities as fully functioning mini computers. Dozens of brands, styles, and costs are commercially available, including the Apple Watch and devices from Android Wear, LG, Samsung, Huawei, Asus and Sony. Prices range from under $200 to over $1,000. The range of app choices is also growing rapidly. Examples of available apps includes supports for cooking, news, Pinterest, voice texting, grocery shopping, gaming, video chat, health and fitness tracking, city guides, Uber rides, dating/social networking, medication reminders, voice recording, schedule reminders, food ordering, sleep tracking, "to do" lists, and even apps that organize other apps on the relatively

small screen display. Examples of a *smart watch* being used as an effective support tool for caregivers are in areas such as: behavior tracking, sleep, activity/health monitoring, and location tracking. *Smart watches* also can directly benefit individuals with IDD as well in areas such as providing medication and other reminders, fitness tracking, memory and other games, home automation, reading text, personal location tracking and directions, speed dialing, and other supports that have more commonly been typical of *smart phone* capabilities. Like all computers, benefits from *smart watch* use may be optimized by personalizing the apps and configuration of the device to suit the needs and abilities of different users.

Many aspects of health can be monitored with sensors built into the *smart watch*. These may include, fitness tracking, environmental sensors (light intensity, humidity, sound intensity etc.), heart rate, body temperature, air quality, electrocardiography (ECG) monitoring, sleep activity, and even seizures. *Embrace watch* is a smart watch that recognizes the onset of a seizure and sends a message to a caregiver. *Embrace watch* was approved by the Federal Food and Drug Administration (FDA) on January 26, 2018. In a clinical study with 135 patients diagnosed with epilepsy, the *Embrace Watch* successfully identified 40 out of 40 generalized tonic-clonic seizures (Department of Health and Human Services Food and Drug Administration, 2018).

If a *smart watch* can operate independently, there is potential to connect it with other medical devices and share valuable health/wellness information with caregivers. Take, for example, a glucometer. By being connected to a glucometer, a *smart watch* may be able to keep track of one's blood sugar levels and notify a caregiver if a problem is identified. A *smart watch* application may be used to identify a potentially hazardous situation and notify a caregiver or emergency services in time to avoid a crisis. In the event that a caregiver is notified, the caregiver could call the individual and talk them through the incident or in the case of an emergency, use the *smart watch*'s tracking feature to identify the individual's location and send help.

ARTIFICIAL INTELLIGENCE AND COMPUTER VISION

When the focus groups and telephone interviews were conducted, 11 of 56 respondents cited privacy concerns as something that was disliked about remote support. During these responses some of the respondents specifically cited cameras as the key technology that made them feel like there was an invasion of their privacy. One respondent said: *"I don't want to be on camera all the time."* Another respondent said that she felt like she was being "babysat in [her] own house."

In some situations, the ISP process might determine that the remote support's least intrusive option may necessitate the use of a camera in the home. Generally, if a camera is used, it is used in only in the common areas of the home such as the front/rear door, living room, or kitchen. When cameras are deemed necessary, they may require that a remote staff monitor the video images and sound coming from the home. Often the camera becomes operational as the result of a trigger, such as someone opening or closing the front door or someone entering a room.

Advances in technology may provide a way to continue to benefit from camera use without needing a remote staff to be watching at the other end. Computer vision is capable of accomplishing this. Computer vision allows for a computer to identify what is happening through the lens of the camera. One company has been piloting the effectiveness of computer vision to identify specific types of fish being watched through a surveillance camera. Rather than asking someone to sit in front of a screen and personally count each trout that swims by, the process has been automated using computer vision (Vincent, 2018).

Dr. James Davis, a faculty member at The Ohio State University Department of Computer Science and Engineering, is developing advanced video surveillance systems that use computers equipped with video cameras to not only detect the presence of people and track them, but also to identify their activities. The first author of this White Paper contacted Dr. Davis to ask about his research and experience with computer vision. Dr. Davis explained the difference between binary sensors and artificial intelligence (AI) then provided some insight into how computer vision may help to promote feelings of greater privacy.

People often make the mistake of thinking that AI is programmed to use cognition. Rather, AI is a program that is able to respond to a situation and learn from it. This is used with trend modeling. Trend modeling is a system that uses artificial intelligence to pick up on certain trends. Dr. Davis mentioned sound as an example of a trend that a camera equipped with trend modeling might pick up on. The cameras discussed would be able to identify when an abnormal sound is made. At this trigger the computer would identify that this anomaly is something for the camera to pay attention to. Vehicle noises would be recognized by the machine as common and therefore not interesting. However, sounds that were atypical, like human voices, would be identified as important. The cameras face a specific direction, until they identify a sound that triggers a predetermined set of actions, in which case they are able to swing toward the sound to identify what it is.

Artificial intelligence, including machine learning, is a vehicle for gathering larger chunks of information than is possible when using a binary sensor. They work based on probability. For instance, going back to the example of the camera that uses trend modeling, the camera may determine that it's likely to identify human voices between the hours of 2:30PM and 4:30PM because between these times children are being released from school and walk home. What might be rarer is hearing a voice at 2:00AM. People are rarely walking in this area at this time, so this would be something worth paying attention to.

Ali Rahimi, engineer/Founder and CEO of Medforall, a remote support vendor in central Ohio, stated that computer vision and AI may also have a role when remote support is adapted for the community. Technological issues with cell signal or power failure may be mitigated by AI by autonomously identifying normal routines in the community and detecting abnormalities, even without the usage of traditional data transmission and processing over a network.

Dr. Davis explained that other types of sensors pick up binary input. These are known as binary sensors. Instead of listening to many different sounds and using probability to determine if something is interesting, binary sensors only detect the presence or absence of a certain property. These are already used with remote support. These sensors can tell a remote support vendor that the door is either open or closed; the motion detector sensed movement or it did not sense movement; the microwave is on or the microwave is off. These types of sensors are, therefore, limited in what they are able to identify and communicate to the remote support vendor. A sensor that identifies that the stove is on cannot identify whether the stove is being used correctly. But the sensors are able to trigger other events. For example, if a motion detector is activated at 2:00am then the movement detector might also trigger the activation of other technologies such as an intercom or a video camera. This way remote support vendors can prioritize and optimize the efficiency of their remote staff. While a remote support vendor could be serving 200 individuals, a vendor may only need 2 or 3 staff members to monitor the sensors because only a small subset is likely to be engaged at any point in time.

As it turns out, the equipment to include AI with cameras is relatively inexpensive and should be affordable with the current Ohio DD waiver purchasing caps for remote support equipment. Rather, the reason why using AI with cameras has not yet become more mainstream is because of the number of false positives that result when using AI. Since AI uses probability to determine if an action is needed, it can often identify something that the computer thought was of interest but was actually a false positive.

The probability can be altered for accuracy. But, when AI is used during situations of extreme importance, it may be beneficial for the probability to be kept low. For example, if a camera in an airport is trying to identify whether or not someone is carrying an explosive device, it may be beneficial to identify the situation when the probability is low (e.g., the likelihood that this person is carrying an explosive device is 6% rather than 15%). This way, it is more likely that the situation is identified as early as possible. However, if the computer is rarely less than 6% sure that there is bomb in the building then this could be a system that is constantly engaged and therefore would promote wasting time and resources.

When asked about the use of computer vision and AI in the home as tools to reduce privacy concerns, Dr. Davis suggested using a method called sensor fusion. While only using computer vision may result in many false positives – combining the technology with sensors would help to reduce false positives and raise the likelihood that when an event occurs it is identified by the computer (Davis, personal communication, March 31, 2017).

Use of remote support services should always be personalized to the individual's need. There is no cookie-cutter approach to identifying when cameras should be used in someone's home. Here are a few examples where computer vision combined with sensor technology might prove useful. One case example involves a person who has difficulty controlling

her seizure activity and is concerned that a seizure might happen and she is unable to call for help. Her home is equipped with a motion detector that works based on probability and based on activity level it might identify that there is a 40% likelihood that this individual is having a seizure, but the computer vision only registers 1% likelihood, then the detection is dismissed as a false alarm. But if the two technologies corroborate one another's findings then the camera could be accessed by a remote support worker to identify what is going on and respond accordingly.

Another capability of computer vision would be to distort the camera's view in such a way that someone could have maximum privacy while still having a camera in the home. By using a depth sensor, only the silhouette of the person is detectable and one cannot make out any intimate details of the person. Hence the appearance of the person is fully protected (Planinc, Chaaraoui, Kampel, & Florez-Revuelta, 2016). In this case, AI is not necessary. Someone can watch the camera and would be able to identify important things, such as a fall, but avoid any of the details mentioned in the above quote.

Medforall is currently using computer vision with their implementation of remote support. The following is a case example describing how Medforall uses this service:

> *"John is 49 years old and has autism. He was living independently until he had a fall that resulted in his need for around-the-clock staffing. Like all of us, John enjoys having his privacy; and having a stranger in his house every hour of every day can be stressful. On the other hand, if John were to be left alone at will, similar accidents are almost certain to happen again; if this conflict is not immediately addressed, one of these falls could easily cost John his life.*
>
> *Medforall's solution to this problem was to install cameras in the common areas, motion sensors in the hallway and stairs, give John a wearable device to detect various activities (including a fall). This set of technologies would allow John to be more independent without sacrificing his safety. However, there is still the bedroom that we don't have any coverage for. If anything happens that requires assistance, remote support staff should be able to assess the situation in order to take the most appropriate assistive measures. This is where we can utilize computer vision and artificial intelligence to detect different activities and relevant human postures without requiring the continuous use of wearable devices. Just a few years ago these technologies cost multiple tens of thousands of dollars, but today we can use advanced depth perception, and active, long-range infrared sensors in conjunction with high-performance edge processing to provide us with the most accurate possible client data at a fraction of the original price. These cameras and their processors provide our AI with raw visual and sensory data that can recognize what behaviors are normal and to be expected, and what client activities require*

> *intervention from a human remote support technician. One way that John can interact with the system is by waving at a camera or saying key words, ensuring that there is no space in his home where he is unable to instantaneously request assistance from his support team. Using computer vision for John's case demonstrates how we can utilize these technologies to advance personal independence while still improving the safety of our clients.*
>
> *Another valuable use for computer vision is for task management and skill development. Our system will recognize when John loads the laundry so we can set an automatic timer to remind him to pick up his laundry only when it's ready. This way we can help John avoid unnecessary trips down to the basement, thereby circumventing the need to compulsively use the steep staircase that poses a particularly high risk of falling for him."*
>
> - Rahimi (Personal communication, April 9, 2018)

As computer vision develops, it's possible that using binary sensors to monitor an individual's health and safety would be considered obsolete by the capabilities presented by computer vision. "*Since image and video can provide very rich data about a person's activity, research has also been carried out to enhance monitoring systems with security and privacy protection techniques. In this sense, cameras can provide rich sensor data for human monitoring, not only complementing systems with networks of binary sensors, but potentially replacing them in the near future*" (Planinc, Chaaraoui, Kampel, & Florez-Revuelta, 2016; p. 2). Computer vision may be used to monitor human behavior and activity, number of individuals in a home, detect falls, analyze gait, and measure some physiological variables. On the other hand, other sensors may also be introduced that accomplish the same purpose for which a camera was initially installed. Periodically reevaluating the technologies used for less intrusive hardware and software may help individuals feel greater privacy in their homes and should be a routine part of the ISP review process.

EMERGING TECHNOLOGIES

HEALTH/MEDICAL SUPPORT

Technology may dramatically change the way we approach health. Autonomous vehicles may one day provide the solution to the most intransigent barrier of all, transportation. Big data will allow better statistics to be produced and keep better record of our own health concerns. *Smart watches* will monitor our vitals and potentially alert us to health problems before they occur. Smart pendants may autonomous notify a caregiver of a fall or seizure. The medications we take may upload information about our bodies directly to our doctors and caregivers. Finally, through the use of telehealth, we may access health care remotely from the comfort and convenience of our homes.

Largely these changes will occur as a result of the growing ability to use sensors to track small bits of information about people that will be used to improve the health industry. *Proteus* recently received approval from the FDA to use a pill with a sensor in it to track the frequency at which one is taking their medication. According to *Proteus*, the digital pill may be able to reduce medication non-adherence. "*Non-adherence along with suboptimal prescribing, drug administration, and diagnosis could result in as much as $290 billion per year in avoidable medical spending or 13% of total health care expenditures*" (NEHI, 2009). Another recent technology approved by the FDA is a *smart watch* called *Embrace* by a company called *Empatica*. Embrace is able to identify when someone is having a tonic-clonic seizure and notify a caregiver.

Technologies like the ones listed above will be helpful as doctors are provided access to health data. One of the implications of this change is telehealth. Telehealth uses technology to monitor and respond to one's health from a distance. It involves the use of technology to connect health professionals with others in the community from a remote location. There is potential for a service such as this to alleviate medical costs incurred as a byproduct of not seeing a doctor and Medicaid expenses used to pay for hospital visits and ambulance transportation. Under the telehealth model someone could have a face-to-face appointment with their primary care physician using two-way video communication. Telehealth technology must be secure and meet the requirements of the Health Insurance Portability and Accountability Act (HIPAA).

Telehealth is already being practiced by some organizations (including the Ohio Department of Developmental Disabilities). Vanderbilt University's Treatment and Research Institute for Autism Spectrum Disorders (TRIAD) is using webcams connected to computer monitors and iPads in individuals' homes and at remote clinic-based locations to assist with diagnostic evaluations for autism spectrum disorder. The webcam at the remote clinic-based locations is able to tilt, pan, and zoom if needed. Features such as these have helped clinicians to keep up with families even when they need to get up and attend to a family member. In the home, TRIAD uses an iPad and a robot known as a Kubi. The robot is advertised as an engaging tele-presence robot. This provides the same capabilities that the webcam would be able to accomplish.

Some of the motivation for this is to enable access to resources for those living in rural communities. This lowers the wait-list for services from Vanderbilt. According to a Webinar session featuring Dr. Alacia Stainbrock from TRIAD, their clinicians have been able to reach agreement 80% of these remote location diagnostic evaluations (Stainbrock, 2018). Therefore, it is only the other 20% of individuals that they ask to travel to the University for further evaluations.

By using telehealth, there is a greater access to routine and specialized healthcare services. Telehealth can help alleviate some of the barriers to accessing healthcare services. Another benefit can also be that the time previously spent in waiting rooms could be reduced and better used. This creates more time to pursue activities that the individual

desires. The benefits of such a service may outweigh the potential downsides. While cost savings may occur for both the healthcare industry and agencies that provide the staff and transportation to the doctor's office – cost savings associated with waiting too long to see a doctor may also occur for the individual. Telehealth may promote access to healthcare despite geographic and socioeconomic barriers (Schumacher, 2015). "*Rural communities experience a general shortage of healthcare—20% of the nation's population lives in rural areas, but rural areas only have 9% of the physicians*" (Holt & Galligan, 2008). In fact, according to a 2013 report, across Ohio, adult Ohioans with disabilities report delayed medical treatment three times as often as their counterparts without disabilities. The same study points out that "*Ohioans with disabilities also report having more problems with seeing a specialist when needed, 10.9% to 4.7%, and having problems paying medical bills, 20.7% to 6.7%, compared to Ohioans without disabilities*" (Ashmead, Havercamp, & Sahr, 2013). The pace at which telemedicine operates may also benefit some individuals with intellectual and developmental disabilities. According to a study conducted by Akron Children's Hospital, "*...telemedicine technology may be superior in some situations by allowing the visit to be performed at a pace that can be adjusted to the needs of the child with DD*" (Langkamp, Blakemore, & McManus, 2015). This study used asynchronous telemedicine, meaning that the telehealth services were not conducted live allowing those involved to work at their own speed.

ROBOTICS

Merriam-Webster defines robotics as "*Technology dealing with the design, construction and operation of robots in automation,*" often toward the goal of performing manual tasks. While much of the work that is being done in this area targets military and mainstream applications, the potential of robotics for assisting individuals with disabilities is unprecedented. This recent excerpt from the Paris Innovation Review provides some anticipation of a future of robots in everyday life:

> *"Robots will soon be able to read texts for us, engage in conversations, clean our windows, deliver packets and parcels, prepare our pill-boxes and even help us get back on our feet should we fall, or have difficulty just getting up...now we see a new generation coming, prepared to do household chores, maintenance work, leisure activities or engage in educational activities. Whether they be macro-, or nano-, humanoid or dronoid, these robots are about to become our future companions."*
>
> Paris Innovation Review (2014)

Already numerous robots are available to assist in a wide range of home use needs. Along with the increasingly common *Roomba* automated vacuum cleaner, There is also *Grillbot* that can cook steaks; *FoldiMate* to fold your freshly cleaned clothes; *Pillo*, which uses facial recognition to dispense your medications; *Kobi* to take care of your leaf, snow and lawn maintenance needs, and the *Ohea Smart Bed* that will make itself each morning.

A more in-depth example is provided by the *Moley Robotic Kitchen* (http://www.moley.com/), set to be released commercially in 2018. Meal preparation is a basic need in the life of every person, and not coincidentally one of the most common support areas for individuals with disabilities. This system was named *Best of the Best* at the *2015 Asian Consumer Electronic Show* and is designed to work with an iTunes-like library of recipes and prepare them "*exactly as the MasterChef would have cooked it…*" It features a fully functioning robot deployed as two fully articulated robotic arms/hands integrated into a complete, professional kitchen. The kitchen is operated by a touch screen or remotely via smartphone.

The potential for emerging robotics technologies in the home can be seen in projections made by the *International Federation of Robotics* (IFR) regarding future sales of "*professional service robots.*" The IFR estimates that by 2019 sales forecasts indicate an increase to upwards of 300,000 units sold at a total value of more than $23 billion. While initial costs of robotics designed to support home-living is likely to be high, prices will become more affordable as adoption increases.

AUGMENTED REALITY

Augmented reality and virtual reality can be easily confused with one another. Virtual reality could be compared to putting yourself inside a digital environment. As its names implies, virtual reality (VR) allows for a complete immersion of the visual sense, this new 3-dimensional (3-D) environment is completely computer generated. Creating the illusion that the user is in the displayed environment or location. It can transport the user inside of a movie or a video game by putting the screen in front of the user's eyes and orienting everything seen around where the person within a digital environment.

Augmented reality (AR) changes the environment that's already there and includes an overlay of digital information. It can be defined as "*a content display technique that provides learners with a connection between virtual object and real environment*" (Wu, Lee, Change, & Liang, 2013). Rather than using a pre-constructed environment, AR uses technology to map what the user sees in the physical environment. It can identify surfaces and place digital 3-D models within that environment.

Various devices can accomplish this. *Smart phones* are one example. The *Sony Xperia Z1* comes with an application that could take pictures and video with animated prehistoric environments placed on top of surfaces. One is able to take pictures with dinosaurs on their dining room table or pterodactyls flying over their spouse's head. While this feature is fun and serves as a simple example of what the technology is doing, it doesn't reveal how the technology might be used to benefit others. However, some believe that, with the right hardware, great software could be created that might help promote increased independence for individuals with intellectual and developmental disabilities.

There has been a race for some time to craft and bring to market glasses or goggles that would allow someone to have the ability to use augmented reality with everything they see. Two of the most prominent companies for augmented reality glasses right now are *Magic Leap* and *Microsoft HoloLens*.

HoloLens is as powerful as a computer. It runs on Microsoft's most current operating system. The device is operated through hand gestures and, when wearing the goggles, it looks as though hologram-like 3-D images are a part of the room.

The best way to describe what this might look like would be to imagine ourselves within the environment which it's used. The living room may be the easiest example because much of the way that this technology will initially be used is for entertainment purposes. But the kitchen may be a better example for how this technology may one day promote increased independence for people with intellectual and developmental disabilities.

Imagine your own kitchen: remove all photographs and artwork, take down reminder notes, remove the calendar if you have one, and anything else that may be replaced digitally. Now imagine looking through the *HoloLens*. All of the photographs that were on the wall have been replaced with clips of home videos, reminder notes have been incorporated in a single icon that expands when it's "touched" or gestured toward. Animated holograms that represent the day's activities are sitting atop digital shelves within your wall.

Let's first look at a technology that is already being used with other technologies called *Task-Prompting*. The concept of step-by-step electronic prompting systems has its roots in the ground-breaking work of Marc Gold on the benefits of employing task analysis for skill acquisition (Minnesota Governor's Council on Developmental Disabilities, 2017). Gold's "*Try Another Way*" approach encompassed the concept of breaking tasks down into the number of steps needed to match the abilities and needs of different people with IDD in different situations. This individualized approach has been applied to electronic platforms that allow instructors to break-down various activities of daily living tasks into concrete steps that are then portrayed sequentially via audio instructions, digital pictures and/or short video clips all targeted at depicting correct performance of each step.

Now, let's consider how this technology may be used in the kitchen while cooking. With augmented reality, this method can be used in a new way. Imagine having preselected recipes with icons or hologram representations stationed where appropriate around the kitchen. When someone selects the icon that indicates they want to cook macaroni and cheese, all the previous icons disappear and one appears over the cupboard where the macaroni and cheese box is located. The icon is joined by a video of someone taking out the box of macaroni. Once this task has been completed another icon and video arrive at the cupboard where the pots and pans are stored. Next, the same thing happens by the faucet with a video of filling a pot with water. This continues through the entire process of cooking macaroni and cheese.

Another way this may be used is to have a digital representation guide someone through the cooking process. Therefore, instead of having various icons – an animated person or cartoon chef could model the action and guide someone through the activities at the pace that would best assist the individual. This could be done outside of the kitchen also. For example, the technology could be worn while completing other household chores. While still able to comprehend one's environment, digital representations could guide someone through the process of sweeping, mopping, doing dishes, etc.

Medforall, a provider agency and remote support in Ohio, is developing an app for Microsoft's *HoloLens* that will allow the user to control home automation and assistive devices. It's designed so that when the individual looks at the door, the app shows if the door is locked and gives the option to open or unlock the door using voice commands. Medforall sees AR as a powerful tool to assist individuals with IDD and physical disabilities. The telepresence feature would allow someone with autism spectrum disorder to use holographic communication to chat with her/his favorite caregiver, making it seem as though they are speaking in-person, at any time. This holographic representation could be the real caregiver or use an intelligent agent through the use of artificial intelligence (AI). Medforall could also simulate the caregiver during off hours (Rahimi, personal communication, March 26, 2018).

TRANSPORTATION SOLUTIONS

Dr. Joshua Every, an autonomous vehicle expert from the Transportation Research Center in Ohio (USA's largest vehicle testing facility), explained that vehicles are categorized according to the different levels of autonomous ability. The levels range from level 0 – 5 in terms of autonomous ability, with level 0 including no driving automation and level 5 including full driving automation (no need for driver input and with no steering wheel or other controls in the vehicle). Most vehicles on the road today are considered level 1 autonomous vehicles. These vehicles require a human driver in the driver's seat who must maintain or be ready to retake the control but the vehicle also incorporates some driver-assisted computerized autonomous functions such as autonomous cruise control (i.e., using radar/sensor detection to adjust the speed of the car to maintain a safe distance with car in front). A car is not entirely autonomous until it reaches levels 4 or 5 autonomy. The difference between the two is that a level 4 autonomous vehicle has limited capabilities on some roads (for example, this vehicle may not be used on roads with vehicles traveling at high speeds) while the level 5 autonomous vehicles does not have limitations and should be able to operate on any road and under any condition that a human driver could.

Many vehicles on the road today make claims to be autonomous vehicles (AV). There are no cars currently available commercially that are said to have "full self-driving capabilities." As an example, the Tesla Model S is rated as a level 2 autonomous vehicle. This means that while it may be said to have some self-driving capabilities, it still only has partial driving automation. When a car is a level 2 self-driving vehicle, it requires the driver to respond to some objects and events, and also requires the driver to be available as a fallback. Therefore, while these cars are getting closer to becoming fully autonomous they are still built with steering wheels and acceleration pedals because, ultimately, they would require a driver in some situations.

While there are not any commercially available vehicles today that are capable of fully autonomous driving (what would be considering level 4 or 5 autonomy), autonomous vehicle testing without drivers first began in Arizona during October of 2017 (Hawkins, 2017). In January of 2018, General Motors (GM) announced that they would have a fleet of autonomous Taxicabs available for use in 2019. These vehicles are called Cruise AV. The autonomous vehicle will be Chevy Bolts and will be constructed without steering wheels or pedals. These vehicles will be used as autonomous ride-hailing vehicles once available.

Likely, these first autonomous vehicles will operate at 35 mph or less. The autonomous vehicle expert we interviewed proposed that cars will not operate with level 5 autonomy until 2027. Similar to Cruise AV, these will likely be built without the ability for human intervention (i.e., the absence of steering wheels or a gas pedal). These vehicles are also expected to be capable of driving over 35 mph (Every, personal communication, August 30, 2017).

Often, technology is developed in a way in which people with intellectual and developmental disabilities are excluded from the digital environment. In an age where every year we are more integrated into a global digital society, it is imperative that people with intellectual and developmental disabilities not be left behind. If people with disabilities cannot use the technology that others readily access and use, then they will be disenfranchised from the way in which our future society will operate.

One of the questions asked of those who participated in the focus groups and phone interviews included: ***what technology do you think you could use to help you do things on your own or need less help?*** Many responses to this question related to transportation. According to the National Core Indicators (NCI) Adult Consumer Survey, Ohio Report (2016), 31% of respondents said that transportation is an additional service needed. In the same report 36% of respondents reported that transportation is a reason that friends cannot always be seen. The latter is the top reason Ohioans listed under "*Reasons you cannot always see friends*." Further, many people may live in an area that does not have reliable public transportation. Autonomous vehicles may be the first consistent form of transportation that people in these areas have navigated without the need of support from caregivers. It may also be considerable that an autonomous vehicle may be able to pick someone up from their house, eliminating a large portion of first-mile last-mile difficulties. Autonomous vehicles may well be the solution to many transportation barriers.

> *"Successful navigation is not the only challenge individuals with IDD face. Many would benefit from controls that are designed to have an option that provides a user interface with minimal complexity to increase the ease of use… The vehicle's ability to provide supervision and tracking in the form of video*

cameras and GPS would also be helpful for caregivers responsible for the safety and well-being of those with IDD… In addition to potential vehicle changes, it will also be important for many in various disability sub-communities to effectively navigate the challenge of leaving one's house in order to get to a desired location" (Claypool, Bin-Nun, & Gerlach, 2017; pp. 25-26).

Some autonomous shuttles have been piloted in specific locations along fixed routes. *Olli* is an autonomous shuttle created by Local Motors. It is a great representation of an autonomous vehicle that is designed to be accessible. In fact, making *Olli* accessible is a part of their mission. Their website states "*There are many riders with unique needs that Olli doesn't currently account for. We need to prepare for a significantly larger aging population, as well as helping those with mobility, hearing or visual issues, or those with cognitive disabilities.*" (see https://launchforth.io/localmotors /accessibleolli/latest/)

BRINGING TECHNOLOGY TO MARKET

Transferring developments out of research labs is one of the first challenges as the characteristics of research prototypes do not often match the requirement of commercial products that are viable in the market due to cost of production and the mismatch between research objectives and market needs. However, even after a technology makes its way from the research stage to the commercialization stage, there can also be significant hurdles to overcome for a commercially available technology to gain widespread adoption. Reasons for this are many but certainly include lack of awareness of the new technology by the target market, limited marketing reach of manufacturers of products designed for very specialized consumer groups, cost, and the readiness of the market to consider technology options in the toolbox of solutions, particularly in industries characterized by a history where services have predominantly been provided by increasing the number of support staff to address end consumer needs. Thus, while a variety of technologies to benefit those with intellectual and developmental disabilities have progressed from research labs to the level of being available commercially, there is still a significant hurdle to overcome with respect to widespread adoption of these technologies. It should be noted that the intention of this White Paper is not to catalog all types of technologies and technology supports, but to provide enough information for readers to make informed decisions about technology use moving forward. Upon review, this information may be used to determine what features, options, price points, volume, etc., meet the needs of each unique situation. Pilot projects designed to evaluate and benchmark limited implementations of technology supports are more typical than full scale rollouts of technology, but the latter is growing in popularity as the tangible benefits of remote support and other support technologies become more widely recognized.

The technology included in this paper includes some technology that is already being used to benefit people in a way that may promote independence for individuals with intellectual and developmental disabilities. In other situations, this paper may outline the potential that could be seen from various technologies to promote independence for people with intellectual and developmental disabilities. In some situations, software needs to be written for the technologies to reach their optimum capabilities to promote independence for people with intellectual and developmental disabilities.

RECOMMENDATIONS

1. The data from our focus group discussions revealed that the participants held several negative preconceived notions about remote support. These included concerns about privacy, safety, and an inability to provide adequate care. To address this issue, we recommend the following:
    a. Host on the DD agency's website information that is accessible and easy to understand, including images, about the different types of remote support equipment and related technologies that are in use and available.
    b. Conduct an annual education blitz. This educational campaign should aim to inform all users of DD waiver services, their family members/guardians, provider agencies, and service and support administrators (SSA) about the merits of remote support, examples of use, and potential outcomes regarding increased level of independence and safety by remote support users and their parents/guardians.
        i. This educational blitz should include a "step-by-step" guide on how to access and set-up remote support services.
    c. Each state that uses remote support services (or other similar remote support service) should host an annual remote support/technology summit where individuals with IDD, family members, guardians, providers, service and support administrators, and other relevant stakeholders come together to explore/discuss/learn about service innovations and cutting-edge technologies that are available to meet the needs/supports of individuals receiving waiver services.

2. The results of our focus groups and telephone interviews were mostly positive. In fact, 45 of 56 respondents reported that they would recommend using remote support services to a friend. A majority of respondents also indicated that when using remote support, they experienced greater independence while also having a greater sense of safety. We recommend the following:
    a. In Ohio, County Boards of DD need to be supported as they move towards a greater integration of remote support services within the service options offered:
        i. The Ohio Department of Developmental Disabilities (in partnership with other stakeholders) should make available 1-year grants to County Boards of DD to support them as they move towards a shared outcome of increasing the number of individuals with IDD that they service using remote support.
        ii. The Ohio Department of Developmental Disabilities (in partnership with other stakeholders) should develop a central or multi-regional "remote support/technology" support hub to make available resources, share expertise, and provide technical assistance to adults with IDD, their families, guardians, providers, and service and support administrators to assist them with all matters related to remote support services and technology.

iii. The Ohio Department of Developmental Disabilities should include a module on remote support and a module about assistive technology in all (1) introductory and (2) refresher trainings for all County Board of Developmental Disabilities service and support administrators.

b. States that are not currently offering a service similar to remote support should consider developing a 5-year plan that includes a goal of implementing remote support services in all available HCBS waivers for individuals with IDD.

3. Although nine out of every 10 focus group and phone interview respondents reported feeling "some" or "a lot" of privacy when using remote support, nonetheless, 11 of 56 respondents still indicated they experienced a sense of loss of privacy with remote support and this is what they disliked most about remote support. We recommend the following:

   a. To enhance the sense of privacy for individuals using remote support, we recommend requiring regular assessments of the remote support equipment and protocols to ensure that they conform with best-practices and are aligned with the ISP.

   b. To ensure the maximum privacy of individuals, pilot the use of computer vision, an emerging technology, with a group of individuals who use remote support.

      i. Dr. James Davis from The Department of Computer Science and Engineering at The Ohio State University has been researching the use of cameras with artificial intelligence and computer vision.

      ii. Ali Rahimi is a computer science engineer that has argued the potential of computer vision and artificial intelligence (AI) as a means of further protecting individual privacy. Rahimi has been piloting the use of these technologies at Medforall's AI-driven remote support and intelligent monitoring solutions in order to improve the quality of life for individuals with intellectual and developmental disabilities while simultaneously maintaining a high level of privacy and security.

4. Seven of 56 respondents reported malfunctioning technology and equipment failure as the aspect that they disliked most about their experience with remote support. We recommend the following:

   a. At the setup of any remote support services, require an introductory meeting that includes all team members (e.g., individual who will be using the remote support services, his parents/guardian, service and support administrator, other ISP team members, and the remote support vendor) provide a clear

explanation of how the technology works, its limitations, and backup plans in case of equipment failure or any potential disruption in remote support service. There also needs to be an opportunity for questions to answered and concerns to be addressed.

b. The individual's ISP should clearly specify what should happen in the different foreseeable situations including, but not be limited, to the following:

   i. If the technology fails and repairs are needed (who is responsible. How long should repairs take and what will be done in the meantime.);

   ii. If there is a power/connectivity failure or outage;

   iii. If the individual is sick and requires the physical presence of a caregiver;

   iv. If medication administration requires the physical presence of a caregiver.

5. In our examination of the Ohio waiver statistics, we noted that an overwhelming majority of adults currently using remote support were on the Individual Options waiver (93%) and very few of the remote support users were on the other two HCBS waivers available. In an effort to enhance the appeal of using remote support services on the other Ohio HCBS waivers, we recommend separating out the funding for remote support services and remote support equipment so that more individuals who use, for example, the Level One waiver may have sufficient funds available to use remote support for at least 5 hours per week with paid backup support.

6. Develop a technology hub that hosts a list of available remote support and related technologies that can be used to support individuals with IDD, along with images and descriptions of how the different technology can be used to address different support needs of individuals with IDD. Maintain and update this list of available technologies and make it readily accessible by individuals with IDD, their family members, guardians, service and support administrators, and provider agencies' staff. Maintain the list such that it can serve to inform current and potential users about what technologies are available and how they can be used to support individuals with IDD.

   a. We recommend partnering with the state's Developmental Disabilities Council, which often has a technology and communications committee, and explore the possibility of making funding available to support this technology hub via a multi-year competitive grant process.

7. The issues related to the availability of direct support professionals is of national proportion and has been a local and national crisis for decades. Remote support and related technologies have been shown to be effective alternative to the presence of DSP in some cases. We recommend that technology be considered and promoted as a support option of first choice when developing or revising an ISP rather than considering remote support and other technologies as an alternative staffing option to the presence of in-home staff.

8. Remote support may not be a viable option for everyone; However, remote support and other similar technologies have the potential to save money across the nation. We recommend the following:
    a. Conduct an analysis of the impact of using remote support services has on individual resource allocation levels and in the aggregate.
    b. Study case examples of successes with remote support and attempt to identify if there is a prototypical set of support needs that can be equally, or better, addressed by the implementation of remote support.

RECOMMENDATIONS ABOUT CURRENT AND EMERGING TECHNOLOGIES

1. Currently, there is not much robust data available on the use of, or need for, technology by adults with intellectual and developmental disabilities. We recommend the following:
    a. Consider adding the following questions to the NCI Adult In-Person Conversation.
        i. A survey item to determine how the individual uses technology in the home and community.
        ii. A second survey item identifying the technology solutions for Ohioans.

DO YOU USE ANY OF THE FOLLOWING?
Check ALL THAT APPLY

- ☐ Do you pay for purchases using a credit card, watch, or smart phone?
- ☐ Do you use a device with GPS to get about in the community?
- ☐ Do you use a video call to communicate with your doctor?
- ☐ Don't know, no response, unclear response

DO YOU NEED ASSISTANCE WITH THE FOLLOWING?
Check ALL THAT APPLY

- ☐ Paying for purchases
- ☐ Getting about in their community
- ☐ Making and keeping medical appointments
- ☐ Don't know, no response, unclear response

2. According to the National Core Indicators (NCI) Adult Consumer Survey, Ohio Report (2015-2016), 31% of respondents reported that transportation was an additional service needed. In the same report 36% of respondents reported that transportation was a reason that they cannot always see their friends. The latter is the top reason Ohioans listed under reasons why they cannot always see their friends. The Adult Family Survey - Final Report (2016-2017), reported that, on average, 27% of respondents across the nation cited the lack of transportation as an obstacle or barrier to their participation in activities in the community. We recommend the following:
    a. For individuals who have difficulty accessing the community (especially those who have difficulty accessing healthcare services/providers), reduce staff time allocated to providing transportation by:
        i. Piloting the use of telehealth with remote support vendors.
        ii. Using home delivery grocery apps (e.g., Instacart, Kroger, Amazon).
        iii. Partnering with Smart Columbus to use technology to increase independent public transit access (e.g., Smart Columbus project "Mobility Assistance for People with Cognitive Disabilities").
    b. Develop standards for autonomous vehicle use for people with intellectual and developmental disabilities. For example, we suggest that it be required that an autonomous vehicle service used by the Ohio Department of Developmental Disabilities or County Board of DD should meet the requirements of WCAG 2.0 guidelines of accessibility. We would also suggest that each autonomous vehicle be equipped with a way to directly connect the passenger with their caregiver; use sensors to identify any health emergency or situation while the adult with IDD is a passenger (e.g., individual is having a seizure, low blood sugar or

insulin reaction, having a heart attack, or experiencing other foreseeable health emergency that may be detectable by wearable sensor technology); and be prepared to pull over in the event the individual in the vehicle is having an emotional or behavioral event that could result in an unsafe driving situation.

   i. Collaborate with local enterprises, such as the Transportation Research Center (TRC) and Honda, to ensure that autonomous vehicle software is being developed in a way that would ensure their cognitive accessibility for individuals with intellectual and developmental disabilities.

c. The Ohio Department of Developmental Disabilities (in partnership with other stakeholders) begin conversations with companies that are developing fleets of autonomous vehicles and are currently field-testing the use of autonomous vehicles in various regions around Ohio (e.g., Smart Columbus project).

   i. Other more national examples might include, but are not limited to: Google's Waymo, Uber, Lyft, and General Motors' Cruise.

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GLOSSARY

Action Agent—A component of a remote support system that provides end users with the ability to create rules triggered by alerts. These rules, or policies, associate certain sets of conditions with storage resources and define actions to be taken when these conditions are detected. Also referred to as Rule Manager and other terms.

Active Support Services—as related to remote services, offers continuous staff oversight for individuals needing constant support.

Activity Log—A type of report in which all recorded events are organized

Alert Manager—A feature that generates a ticket when an event occurs and sends notification messages to the designated people. The ticket lets you track the event, send email alerts about the event, and maintain a history of events.

Alert Monitor—A window that provides information about objects that have failed or experienced

Assistive Technology—Any product, device, or equipment, whether acquired commercially, modified or customized, that is used to maintain, increase, or improve the functional capabilities of individuals with disabilities

Broadband—The broadband signal transmission infrastructure includes wires, microwaves and fiber optic cables, which must be maintained for the provision of telehealth and remote services. The better the connection (bandwidth quality), the more data can be sent and received.

Call Tree—A call tree is a layered hierarchical communication model used to notify specific individuals of an event -- typically unplanned in nature -- and coordinate recovery, if necessary. A call tree is also known as a phone tree, call list, phone chain or text chain.

CDS Cross-Platform Data Sharing—Sharing data between heterogeneous systems (such as Solaris and HP-UX operating systems), where each system has direct access to the physical devices used to hold the data, and understands the data on the physical device

Dispatch Staff—Staff that are on stand-by that are dispatched to provide hands-on assistance, assessment or other support needs identified by a remote support system.

DSS Decision Support Systems—Computer-based systems used to model, identify, and solve problems, and make decisions.

Digital Video Surveillance—An appliance that enables embedded image capture capabilities that allows video images or extracted information to be compressed, stored or transmitted over communication networks or digital data link. Digital video surveillance systems are used for any type of monitoring. Digital video surveillance systems can be used for nearly any environment.

Drop-in Support Services—As it relates to remote support programs, provides staff assistance at scheduled intervals or certain times during the day, such as when an individual is scheduled to take medication.

Fall Detection—The various existing detection devices can be divided into wearable and non-wearable systems. Wearable systems generally consist of placing an accelerometer upon the subject which can detect changes in acceleration, planes of motion or impact in order detect falls. Non-wearable systems include cameras, acoustic sensors and pressure sensors that are placed in the subject's normal environment and use various measurements to determine if the subject has fallen.

Live Video (synchronous)—Live two-way interaction between a person (patient, caregiver, or provider) and a provider using audiovisual telecommunications technology. This type of service is also referred to as "real-time" and may serve as a substitute for an in-person encounter when it is not available. Live video can be used for both consultative and diagnostic and treatment.

Medication Reminder Systems (MRS)—A medication reminder system (MRS) is an electronic device programmed to provide a reminder to an individual when medications are to be taken. The reminder may be a phone ring, automated recording or other alarm. This device is for individuals who have been evaluated as able to self-administer medications with a reminder. The electronic device may dispense controlled dosages of medication and may include a message back to the center if a medication has not been removed from the dispenser. Medications must be set-up by an RN or professional qualified to set-up medications.

Mobile Health or mHealth—Mobile health or *mHealth*, a relatively new and rapidly evolving aspect of technology-enabled health care, is the provision of health care services and personal health data via mobile devices. *mHealth* technology uses devices such as smart phones and portable monitoring sensors that transmit information to providers, as well as dedicated application software (apps), which are downloaded onto devices. Given its recent emergence into this field, policies governing the use of this technology are continually being shaped.

Monitoring Staff—Staff members that are trained and assigned to oversee conditions and potential needs of individuals receiving remote support. Monitoring staff may also serve as a first point of contact for problem solving, may initiate call tree actions, may dispatch staff to provide hands-on assistance, or otherwise identify potential problems and needed supports.

Needs Assessment—Assistive technology assessment is best thought of as a collaborative process by which a team determines what technologies would improve an individual's performance, participation, and independence. This process should take into account not only the individual's learning strengths and weaknesses, but also the nature of specific tasks to be performed, and the environments in which the person performs these tasks -- the physical environment, social environment, and the context (such as working independently or with others). The process may also utilize the services of an outside AT specialist to conduct specialized evaluation and training. AT assessment may also consider necessary supporting services such as training for individual and/or staff, integration of the AT into school, work and home life, and technical support provisions. It also can provide a plan for implementation and evaluating progress and outcomes. AT assessment always considers the perspective and inputs of the individual user. Because understanding the individual's learning weaknesses and strengths is such an important part of the AT assessment process, it is often helpful to obtain a diagnostic or psycho-educational evaluation from a qualified professional prior to conducting an assistive technology needs assessment.

Personal Emergency Response Systems (PERS)—Personal Emergency Response System (PERS) is an electronic device that enables an individual at high-risk of institutionalization to secure help in an emergency that is connected to a device and programmed to signal a response center once the help button is activated. The response center is staffed with trained professionals. The service is generally intended for those who live alone, live with others who are unable to summon help, or who are alone for significant portions of the day, have no regular caregiver for extended periods of time and would otherwise require extensive routine supervision.

Remote Monitoring—see "remote support."

Remote Support—Remote support means the monitoring of an individual in his or her residence by staff using one or more of the following systems: live audio feed; motion sensing system; radio frequency identification (RFID); web-based monitoring system; live video feed; or other devices. The system may include devices to engage in live two-way communication with the person being monitored (definitions may vary by state).

Remote Patient Monitoring—Remote patient monitoring (RPM) uses digital technologies to collect medical and other forms of health data from individuals in one location and electronically transmit that information securely to health care providers in a different location for assessment and recommendation. Monitoring programs can help keep people healthy, allow older and disabled individuals to live at home longer and avoid having to move into skilled nursing facilities. RPM can also serve to reduce the number of hospitalizations, readmissions, and lengths of stay in hospitals—all of which help improve quality of life and contain costs.

Telecare—Telecare is the use of information, communication, and monitoring technologies which allow healthcare providers to remotely evaluate health status, give educational intervention, or deliver health and social care to patients in their homes. Also, Telecare (aka telehealth) has become a worldwide, modern way of giving care over distance by means of technology. Other concepts, like telemedicine, e-health, and telehealth, focus on the same topic though the boundaries between them seem to be blurred. The definition of telecare competes with concepts like home-based e-health, telehomecare, telephonecare, telephone-based psychosocial services, telehealth, and telemedicine.

Telehealth—A collection of *means* or methods for enhancing health care, public health, and health education delivery and support using telecommunications technologies. *Telehealth* encompasses a broad variety of technologies and tactics to deliver virtual medical, health, and education services

Third Party Access/Family Support Services—With regard to remote support, technologies or procedures that connect authorized users with clients via a password-protected website.

Store and Forward—Store and forward technologies allow for the electronic transmission of medical information, such as digital images, documents, and pre-recorded videos through secure email transmission. This information can include X-rays, MRIs, photos, patient data, and even video-exam clips. Store and forward communications primarily take place among medical professionals to aid in diagnoses and medical consultations when live video or face-to-face contact is not necessary. Because these consultations do not require the specialist, the primary care provider and the patient to be available simultaneously, the need for coordinating schedules is removed, and the efficiency of the health care services is increased. These technologies provide important benefits to patients and providers. Some of these benefits include:

- Patients can get timely specialty care without needing to travel beyond the location of their primary care providers;
- Wait times for specialty care are lessened, especially in areas with shortages of medical specialists;
- Primary care providers and medical specialists can review patient cases, regardless of their respective locations;
- Medical specialists can review patient cases when it is convenient for them;
- The Store and Forward process can overcome language and cultural barriers.

WIRELESS-TYPE SENSORS

Wireless Accelerometer—Accelerometers can be used in a host of applications where knowing impact, vibration, inclination, etc. is required.

Wireless Activity Detection Sensor—Activity detection sensors can be used in a host of applications where detecting vibration, or sudden movement etc. is required. Activity sensors can detect sudden movement or non-movement of a given device or surface, and alerts the user of the change.

Wireless Asset Sensor—Asset sensor can be attached to an asset or object and outputs an RF signal at set intervals to be received by a gateway and monitoring system. The sensor can be used to determine if an asset is removed from the premises and send notifications via SMS text, email or voice call to alert the user.

Wireless Button Press Sensor—The touch activated wireless button sensor allows a notification signal to be sent when immediate contact is important. This button may include an LED response indicator to confirm that the system has received the alert.

Wireless Carbon Monoxide (CO) Gas Sensor—Carbon monoxide sensor allows you to monitor the level of carbon monoxide (CO) gas in the surrounding air. Battery may last over a year at 1-hour heartbeat. User customization may support setting the frequency of readings and the ability to set customized alerts via SMS text or email when the sensor detects CO levels outside of the user's defined safe levels.

Wireless Dry Contact Sensor—Dry contact sensors can be used to detect contact between two wired contact points. This sensor can be used with an external mechanical switch or a contact plate to alert the user via SMS text and/or email when the contacts touch or a switch is triggered.

Wireless Humidity Sensor—Wireless humidity sensors allow you to monitor the relative humidity of the air within a room or enclosure. Ideal for monitoring humidity within greenhouses, industrial spaces, museums, saunas and humidors. They can also be used for residential applications such as controlling mold, mildew or dust mites.

Wireless Infrared Motion Sensor—Motion sensors use an infrared sensing technology to accurately detect movements made by people/animals within a designated range. User customization may support receipt of notifications by SMS text or email the instant motion is detected.

Wireless Light Detection Sensor—Light detection sensors can be used to detect whether light is present or not. The sensors can be user calibrated for baselines of light and dark and will provide a status of light presence based on those baselines. Alerts can then be setup for when light has been detected or when there is no light detected.

Wireless Light Meters—Light meters measure the intensity of light in lux (luminescence/unit area), from 0 – 1000 lux (indoor range). User customization may support setting the frequency of readings and the ability to set thresholds for notifications and alerts by SMS text, email or voice call from the system.

Wireless Liquid Level Sensor—Liquid level sensors use a solid-state, resistance sensitive ribbon sensor to measure the level of a liquid in a container. User customization may support setting the frequency of sensor readings and the ability to set thresholds for notifications and alerts.

Wireless Open-Close Sensor—Wireless open/closed sensors provide information on the status of doors, windows, cabinets, etc. Know if a building or area is being accessed when it should not be, or if a door or window has been left open. Alerts can be setup to notify a user by SMS text, email or voice call if a door or window has been opened or left open.

Wireless Pressure Meter—Pressure meters measure pressure from a 5 volt pressure transducer and transmits the pressure measurement. By connecting the wireless pressure sensor to a pressurized gas, liquid or vapor supply line, it can measure the pressure within the line and send data to a sensor monitoring and notification system. User customization may support setting notifications and alerts from the system so users can know immediately if pressure is above or below an optimal range.

Wireless Pulse Counter—Pulse counters can be integrated with up to four dry contact or mechanical switch and closure devices to count the number of actuations occurring within a given time frame for each input.

Wireless Seat Occupancy Sensors—Seat occupancy sensors use a stress plate with an integrated flexible, stress sensitive ribbon to accurately measure when (force) is applied to the plate. Perfect for monitoring seats for occupancy. User customization may support setting the frequency of readings and the ability to set thresholds notifications or alerts.

Wireless Temperature Sensor—Wireless temperature sensors use a thermistor to accurately measure temperatures. These sensors are perfect for monitoring ambient temperatures around the sensors physical location. User customization may support setting the frequency of readings and the ability to set thresholds for alerts via SMS text and/or email.

Wireless Vehicle Detection Sensor—Vehicle detection sensors can be used in a host of applications where detecting vehicle presence or motion is needed.

Wireless Voltage Detection—Detects the presence or absence of electricity. Generally intended for use on battery or other DC sources, up to 50 volts and not intended for use with AC voltages. Works with batteries, adapters, solar equipment, vehicles or machinery, and any other electrical appliance monitoring. The sensor triggers on voltage presence to voltage absence and vice versa. The data is displayed as “Voltage Detected” or “No Voltage.”

Wireless Water Detect Sensor—Sensor can alert you via SMS text and/or email when there is water detected, preventing potential property damage that results from flooding or leaks. Place this sensor anywhere flooding or faulty plumbing could cause a problem. This sensor can also be used to detect a lack of water, allowing you to know when a container is nearing empty.

Wireless Water Rope Sensor—Sensor detects conductive liquids anywhere along the length of the detection rope by using two wires covered with conducting polymer. When water or conductive liquid contacts the rope, the sensor may immediately turn on the RF radio and transmit the data to a wireless gateway or other monitoring and notification system, allowing the user to immediately receive an alert by SMS text, email or voice call. Sensor rope dries quickly allowing the sensor to reset for next use. The sensor can be purchased with an initial length section of water detection rope and can be expanded by simply clicking additional sections of detection rope together.

APPENDICES

Focus Group Questions	**Appendix A**
Telephone Survey Questions	**Appendix B**
Assistive Technology Resources in Ohio	**Appendix C**

APPENDIX A

FOCUS GROUP QUESTIONS

- Tell us your name and how long you have used remote monitoring services.
- How did you first hear about remote monitoring services?
- Tell me about your experience with remote monitoring:
  - What did you like or not like about remote monitoring when you first heard about it?
  - What do you like about remote monitoring?
  - What do you NOT like about remote monitoring?
  - How much privacy do you feel you have in your home?
- If your best friend was thinking about using remote monitoring services, would you recommend that they use them?
- We want to find ways to expand remote monitoring outside of the home. Technology might include a laptop, cell phone, or smart watch. Is there anything like that that you think you could use to help you do things on your own or need less help?
- We want to improve remote monitoring services. Is there anything we should have asked/discussed but did not?

APPENDIX B

TELEPHONE SURVEY QUESTIONS

- How did you first hear about remote support?
- Why did you choose to begin remote support?
- Do you live with roommates?
- What do you like about remote support?
- What do you NOT like about remote support?
- How much privacy do you feel you have in the home?
- How is your life different since using remote support?
- Do you speak with remote support workers?
- How do you communicate with remote support staff?
- Can you tell me about a time when you needed to utilize your emergency backup?
    - Have you ever used the emergency backup?
    - How long did it take for the backup support to respond?
- If your best friend was thinking about using remote support services, would you recommend that they use them?
- We want to find ways to expand remote support outside of the home. Examples of technology might include a laptop, cell phone, or smart watch. Is there anything like that you think you could use to help you do things on your own or need less help?
- We want to improve remote support. Is there anything we should have asked/discussed but did not?

APPENDIX C

ASSISTIVE TECHNOLOGY RESOURCES IN OHIO

1. Assistive Technology and Accessible Education Materials Center
   The AT & AEM Center is a centralized, responsive resource center that empowers individuals with disabilities by providing accessible educational materials, access to assistive technologies and highly specialized technical assistance and professional development support. Powered by Ohio Center for Autism and Low Incidence (OCALI). https://ataem.org/

2. Assistive Technology of Ohio
   AT Ohio's mission is to help Ohioans with disabilities learn about or acquire assistive technology. Assistive Technology refers to devices, equipment or services that assist individuals with disabilities to function independently in the areas of work, home or school. We offer several programs and services to achieve that goal. We also keep up with current legislative activity that affects persons with disabilities, and educate legislators about the needs and concerns of citizens with disabilities. Assistive Technology of Ohio (AT Ohio) is a federally funded nonprofit organization that is part of the College of Engineering at The Ohio State University. AT Ohio is the officially designated Tech Act program for Ohio. https://atohio.engineering.osu.edu/

   Device Lending Library: https://atohio.engineering.osu.edu/device-lending-library

3. Disability Rights Ohio-Assistive Technology: Ohio Lemon Law
   Ohio has a law that gives protection to consumers who purchase or lease an assistive technology (AT) device that is defective. http://www.disabilityrightsohio.org/assistive-technology-lemon-law

4. CAP4Kids-Assistive Technology and Equipment
   Includes links to various AT Resources in Ohio http://cap4kids.org/columbus/special-needs-autism/assistive-technology-and-equipment/

5. Aaron W. Perlman Center
   The Perlman Center is a one-of-a-kind regional resource for helping children, youth and adults with cerebral palsy and other disabilities use assistive technology to actively participate in their environment. Through assistive technology, people are able to break through barriers of disability and chronic illness. https://www.cincinnatichildrens.org/service/a/aaron-perlman-center/assistive-technology

6. Different Needz
   Allows the special needs community to buy and sell gently used and new medical equipment, therapy devices, adaptive toys and more online. The foundation also awards some grants to people in need. http://differentneedz.com/
7. First Hand Foundation
   First Hand is dedicated to impacting the health of children, their families and communities through reactive and preventative initiatives. To fulfill that mission, we provide funding for individual children with health-related needs when insurance and other financial resources have been exhausted. We also create and support programs that identify issues before they become critical and that empower people to take charge of their health. https://www.firsthandfoundation.org/
8. The Ohio State University Nisonger Center
   Offers comprehensive services for children, teens and adults with developmental disabilities and autism spectrum disorders, including an autism clinic, behavior support services, dental care for children with developmental disabilities, psychiatric services and more. They also have a Toy and Technology Library and early intervention programs. Website has an extensive list of resources for families as well. http://nisonger.osu.edu/
9. State Library of Ohio Talking Book Program
   The State Library of Ohio provides access to reading materials to individuals with disabilities through several programs. The State Library, along with the Cleveland Public Library and the National Library Service for the Blind and Physically Handicapped provide audio, braille and downloadable books to eligible residents. In addition, the State Library and the Ohio School for the Deaf partner to provide the Deafness Outreach Collection maintained at the State Library. https://library.ohio.gov/using-the-library/services-for-the-blind/

AUTHORS

Jordan B. Wagner, BA

A technology enthusiast from Columbus, Ohio, Jordan B. Wagner is eager to do what he can to investigate technology's potential to assist people with developmental disabilities by facilitating independence in and beyond the home. He earned his Bachelor of Arts in Psychology from The Ohio State University and has worked in the field of IDD for more than 8 years.

Beginning as a Psychology student at The Ohio State University, Mr. Wagner began his career in the field of developmental disabilities as a Direct Support Professional. In this role, he made many friends who had developmental disabilities and assisted them in areas where it was difficult for them to help themselves. He sought to encourage independence for those with whom he worked and assisted some to set and meet goals. Jordan was aware of the frustration that some experienced as a result of having the constant physical presence of staff in the home and, therefore, is especially ardent about incorporating technology to promote independence where possible.

Currently, Jordan works at The Ohio State University Nisonger Center, a University Center for Excellence in Developmental Disabilities, as Coordinator to the Technology Project. In this role, Jordan has taken the opportunity to incorporate his experience assisting individuals with developmental disabilities, his passion for promoting independence, and his enthusiasm for technology. With the collaborative effort of everyone who works on the Technology Project, Mr. Wagner has worked to familiarize himself with technologies, both current and emerging; collaborate with stakeholders; conduct focus groups and phone interviews with adults with developmental disabilities who have used remote support (also known as remote monitoring) and their parents/guardians; and interview experts about how technology can be used to best promote independence for Ohioans with developmental disabilities.

Marc J. Tassé, PhD

Marc J. Tassé is a Professor in the Departments of Psychology and Psychiatry and is also the Director of Nisonger Center, a University Center for Excellence in Developmental Disabilities, at The Ohio State University. He is a licensed psychologist. Marc has more than 30 years of experience in conducting research and providing clinical services in the field of intellectual disability (ID), autism spectrum disorder (ASD), and other related developmental disabilities (DD). He has been a Principal Investigator(PI)/co-PI on more than a dozen grant-funded projects, including funding from federal, state, foundations and other sources. His publications include more than 130 articles in peer-reviewed journals, book chapters, and books in the area of intellectual and developmental disabilities. He has co-authored several published standardized tests, including scales assessing adaptive behavior, problem behavior/psychopathology, and support needs. He is the senior author of the Diagnostic Adaptive Behavior Scale, which was published in 2017 by the American Association on Intellectual and Developmental Disabilities. He has given 250+ scientific and professional presentations related to ID, ASD, and related neurodevelopmental disorders. Marc was elected Fellow of the American Association on Intellectual and Developmental Disabilities, American Psychological Association, and International Association for the Scientific Study of Intellectual and Developmental Disabilities. He also consults and testifies in capital cases involving the determination of intellectual disability. Marc is a Past-President of the American Association on Intellectual and Developmental Disabilities (2012-2013).

Daniel K. Davies, MA

Daniel K. Davies is Founder and President of AbleLink Smart Living Technologies and has been actively involved in research and development of assistive technology for individuals with intellectual and cognitive disabilities for over 25 years. He has been closely associated with issues important to individuals with disabilities and their families all his life, as his oldest brother John (now deceased) had severe intellectual disability. Primary areas of expertise include human computer interaction, expert-systems and cognitive technology research and development. Mr. Davies has served as Principal Investigator or Project Advisor on over 75 research projects focused on technology and cognitive disabilities funded by the U.S. Department of Education, Administration for Community Living, Accessible Transportation Technologies Research Initiative(ATTRI), National Institutes of Health, the Joseph P. Kennedy, Jr. Foundation, and others. Currently he serves as Co-Chair of the Technology Interest Network (Tech IN) for the American Association on Intellectual and Developmental Disabilities and was awarded the 2004 Technology and Media Leadership Award by the Council for Exceptional Children for "national leadership in the area of research and development of cognitive support technologies." He has been on the leading edge of research into assistive technology for individuals with intellectual disabilities and consequently in 2006 was selected out of 951 nominations from 98 countries to receive the Technology Museum of Innovation's prestigious Katherine M. Swanson Equality award for "pioneering information technology for individuals with cognitive disabilities." He is a recipient of the 1996 and 1997 Technology Transfer Awards from the Colorado Chapter of the Technology Transfer. He has authored over 100 publications, reports and book chapters specifically on the use of assistive technology for individuals with intellectual and other cognitive disabilities and is an invited speaker at technology and disability related professional conferences nationally and internationally

Steven E. Stock, MPA

Steven Stock has served as Vice President of AbleLink Smart Living Technologies since 1998. Mr. Stock's involvement with and commitment to people with intellectual disabilities began at a young age when his uncle with severe intellectual disabilities and spina bifida, Francis Gauthier, came to live at their family home. His work has been published in refereed journals or as academic book chapters on nearly 100 occasions. His 38 years of professional experience with individuals with intellectual disabilities through work as a direct support professional, behavior specialist, training manager, residential director and vocational director at agencies in Colorado and Michigan has provided him with first-hand knowledge of the day-to-day challenges common to individuals with intellectual disabilities. He has been involved in numerous successful SBIR Phase I Phase II projects funded by the National Institutes of Health and U.S. Department of Education, including serving as Principal Investigator on numerous Phase I SBIR and Phase II projects. His experiences have included research and development of agency staff training programs, skill level and adaptive behavior assessment systems, conducting Person Centered Planning quality of life training and implementation programs, designing and managing the transition of agency group homes to apartment programs, managing deinstitutionalization processes, and development of community-based employment programs. He holds a Bachelor's Degree in Social Work from Northern Michigan University and Masters in Public Administration from the University of Colorado at Colorado Springs.