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Expanding possibilities for people with vision loss

Improving Transportation Systems for People with Vision Loss

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Introduction

> "For me, increasing vision loss means I can't drive. I don't live near a bus line, so transportation is a huge problem. First, a colleague drove me, but our schedules weren't always the same. I had to get a part-time job to decrease the number of times I would need transportation help. That cut my income in half." (Sheffield, Rogers, & Richert, 2015)

Personal independence is closely associated with the ability to travel to the places one wants and needs to go. When driving is no longer possible, remaining self-sufficient requires navigating a complex patchwork of public and private transportation systems. For people with vision loss, there are unique challenges to independent travel, such as safely moving through unfamiliar environments. It is essential that people with vision loss are fully considered and included in the design and evaluation of transportation solutions.

The American Foundation for the Blind (AFB) advances systems change by cultivating in-depth and actionable knowledge through promoting and undertaking research that has scalable impact. AFB believes in working together with partners, policymakers, and other influencers to collectively accelerate systems change and to create a world of no limits for people with vision loss. In 2019, AFB's Public Policy and Research Institute examined a broad range of issues associated with vision loss to determine how best to focus its efforts. Access to transportation was identified as one of the areas that is fundamental to promoting the independence of people with vision loss.

Studies point to transportation as a major barrier for people with vision loss—to receiving medical and rehabilitation services, to maintaining social networks, and to retaining and attaining employment. A review of the literature on transportation for people with vision loss found very few studies that address the specific issues related to transportation access and vision loss. While there are articles that refer to the transportation needs of older people or people with disabilities, there is a knowledge gap concerning issues that are unique to people with vision loss and their transportation challenges and successes.

Transportation-related trends that were uncovered in the literature review included "mobility on demand" and partnerships between public transportation systems and ridesharing companies like Uber and Lyft. Autonomous, or self-driving, vehicles are also on the horizon as an important option that may impact the lives of people with vision loss. Innovative transportation pilot projects are being tried in communities that suggest a number of promising practices. Still, few studies identified by AFB staff measured the outcomes of these pilots to provide evidence of the effectiveness of these promising practices.

There is a critical need to improve transportation options for people who cannot drive, and to specifically represent the unique perspective of people with visual impairments in transportation considerations. This paper outlines the transportation challenges encountered by people with vision loss, describes current trends and promising practices, and identifies research and information gaps. Evaluating and advocating new approaches will inform transportation agencies, policymakers, researchers, and others about promising and best practices that can improve transportation systems and promote personal independence for those with vision loss.

Definitions

In this paper, the term **transportation** refers to local surface transportation. This excludes conveyance by air, long-distance train, inter-city bus, or ship but includes travel by foot, on-road vehicles such as cars, taxis, or buses, and commuter trains, subways, and ferries.

We refer to **people with vision loss** as described by The American Community Survey, administered by the U.S. Census Bureau, as "people who are blind or have serious difficulty seeing even when wearing glasses." (Okeke, Wittenborn, & Rein, 2018). In addition to vision loss, terms used to describe individuals who do not see typically, even when wearing glasses, include blind, visually impaired, and low vision.

Other concepts that are referenced in this paper include:

- **Accessible/accessibility**: The ability for a person to access or make use of a product, service, or environment due to its design.
- **Best practice:** A program or strategy that has been shown through research and replication to achieve positive outcomes that are generalizable to a larger population.
- **Mobility management**: Coordination of a variety of transportation providers to deliver comprehensive service to travelers within a community.
- **Mobility on demand (MOD**): A connected transportation system that provides end-to-end, personalized travel by integrating easy-to-access multiple modes of transport.
- **Orientation and mobility (O&M)**: Travel skills for people with vision loss that include knowing where you are (orientation) and how to move safely and efficiently to where you want to go (mobility).
- **Paratransit**: All public transit agencies that provide fixed route service must also provide complementary parallel Americans with Disability Act (ADA) paratransit service for individuals with disabilities who are unable to use traditional fixed-route service and have been certified as eligible.
- **Promising practice**: A program or strategy that appears to be leading to positive outcomes but does not have sufficient research or replication data to be generalizable.
- **Rehabilitation services**: Services that help a person keep, get back, or improve skills and functioning for daily living that were lost or impaired because of sickness, disability, or injury.
- **Rideshare:** Companies that connect passengers with drivers in private vehicles through web-based apps; otherwise referred to as transportation network companies (TNCs).
- **Travel training**: Assistance provided by transit companies to familiarize customers with their transportation system so customers might eventually be able to use the services independently.
- **Wayfinding**: Information systems that guide people through a physical space.

Process

AFB is collecting information about existing options in addition to best and promising practices to connect people who are blind or visually impaired with convenient, affordable, quality transportation services. This information is being shared with stakeholders including consumers, agencies that serve those with vision loss, transportation service providers, and policymakers. AFB staff is gathering insight from several sources, including:

- Interviews with staff from community transportation projects that are piloting novel service options;

- Discussions with rideshare companies that support and subsidize paratransit service options;
- Assessment of regulations that apply to community transportation for people with disabilities including those with vision loss;
- Review of scholarly research and other literature about transportation options for people with disabilities including vision loss; and
- Conducting surveys and interviews with people with vision loss about their challenges, successes, and wishes associated with community transportation.

Analysis

An analysis of research studies and related literature showed that empirical research is lacking on promising and best practices associated with transportation systems for people with disabilities including vision loss. Below we highlight some of the research reviewed.

The Visually Impaired Seniors' Independent Travel Opportunities and Resources study (Project VISITOR) was conducted by AFB and funded by Volkswagen Group of America, Inc., Future Center California. In Phase One of the study, O'Day, Chanes-Mora, and Roth (2019) surveyed 32 agencies serving seniors with vision loss about transportation options in their area. Agencies reported a lack of affordable and convenient transportation options in their communities. In Phase Two of the study, O'Day, Chanes-Mora, and Roth (in preparation) interviewed 81 seniors with visual impairments throughout the United States in urban, urban cluster, and rural communities. Just under a third of urban and urban cluster participants traveled daily compared to only 8% of rural participants. For more than half of those participants living in urban or urban cluster communities, the use of buses/subways or paratransit services occurred daily or several times a week. Four in 10 urban or urban cluster participants reported that lack of transportation prevented them from doing things they needed or wanted to do, and the percentage of those reporting this in rural communities was 58%.

Interviews with 162 adults with vision loss over age 60 were conducted by Corn and Rosenblum (Corn & Rosenblum, 2002, Rosenblum & Corn, 2002a, 2002b). Participants were interviewed about the availability and use of different forms of transportation, ways to access transportation to carry out daily activities, and how nondriving impacted individuals on a personal level. Though the transportation landscape has changed in the almost 20 years since this study was published, it is noteworthy that 75% of the participants reported they had access to public transportation but only half of these individuals used it. Similarly, 72% of the participants reported paratransit services were available in their community but only half of these individuals used this service.

Cmar, McDonnall, and Crudden (2018) analyzed survey data for 327 individuals with visual impairments between the ages of 18 and 65 to explore the correlation between their transportation and employment experiences. The authors concluded that transportation self-efficacy (the self-perception that one can successfully perform a task) was an important predictor of employment, particularly for younger people and for those who experienced significant vision loss more recently. As Cmar et al. explained, past experiences using transportation can influence self-efficacy development and can impact how the person responds to future transportation needs.

In reviewing the studies on transportation and people with vision loss, AFB staff found that the focus was most often on defining the problem rather than examining and testing solutions. Reporting on the existing issues related to transportation is important to identifying and framing the problems, but there is a conspicuous lack of research that is solutions-based. Of the research analyzed by AFB staff, only two

articles presented a promising practice. A report from the National Academies of Sciences, Engineering, and Medicine (2019a) described the *LookingBus* Transit IDEA pilot that addressed the challenges of getting on and off a bus by people with disabilities, especially people with vision loss. The project used sensors in combination with mobile apps to alert drivers when riders with disabilities were waiting for pickup at bus-stops or wanting to get off at a stop. The use of remote infrared audible signage was examined by Marston and Golledge (2003). In this study, 30 participants who were legally blind provided data about their current travel behavior and activities, the number and types of additional trips they desired to make, and what trips they would make if more environmental cues were available. The participants reported that if the environment was more accessible, they would be likely to participate in more work and educational activities, and especially more discretionary activities.

A full list of the articles included in AFB's staff analysis of transportation is available at afb.org/aging.

Transportation Challenges

Findings from Project VISITOR (O'Day et al., 2019, in preparation) and the work of Corn and Rosenblum (Corn & Rosenblum, 2002; Rosenblum & Corn, 2002a, 2002b) point to transportation as a barrier that limits access to medical and rehabilitation services, to maintaining social networks, and to retaining or obtaining employment. McDonnell and Sui (2019) reported that 56% of working age adults with vision loss are not employed. They noted that transportation was reported to be the leading barrier to obtaining employment, accepting jobs that were offered to them, or remaining employed once they were hired.

Similarly, a study of 559 highly educated legally blind adults across the United States found that 79% of respondents said that transportation challenges had a negative impact on their employment at some point in their lives. This was the highest-ranked barrier to employment reported by participants (Silverman, Bell, & Mendez, 2019). Crudden (2018) reported results of a survey of 491 people with visual impairment. Over one-third (38.1%) of participants reported declining an employment offer due to transportation concerns. Employed participants used public transportation (41.9%); paratransit (30.2%); walking (25%); riding with a spouse or family member (18.2%); using a taxi (11.4%); or riding with volunteers, carpools, or hired drivers (17.6%) to get to and from work, with 2.6% driving themselves.

As a woman in Omaha, Nebraska explained,

> "I wanted to apply for an adjunct position teaching English composition at a community college, but the school is not on the bus line. Uber and Lyft were not options because the cost would have been too great compared to my wages. So, I lost out on an employment opportunity because I didn't have other reliable, affordable choices." (Cervenka, 2020).

In addition to limited transportation options, factors that affect the mobility of people with vision loss include:

- Fear of falls, especially in older people (Centers for Disease Control [CDC], n.d.)
- Lack of confidence in navigating unfamiliar places, particularly for individuals new to vision loss who may not have had O&M training (Berger, 2012)
- Lack of knowledge of transportation resources, and how to access and use them (National Aging and Disability Transportation Center [NADTC], 2018)
- Inability to use technology such as smartphones to schedule and/or pay for rides (O'Day, et al., 2019, in preparation)

- Financial considerations reflecting high levels of poverty among people with vision loss (Kirtland, et al., 2015)
- Lack of accessible signage and route schedules (Crudden, 2018; O'Day et al., 2019, in preparation)
- Laws, regulations, and restrictions for types of transports, eligibility, transportation jurisdictions, and certification reciprocity across states and jurisdictions (O'Day et al., 2019, in preparation)

Being unfamiliar with various modes of transportation and technologies discourages their use. For instance, according to the National Aging and Transportation Center (2018), just 6% of older adults use ridesharing services while 26% of younger adults with disabilities do. As these younger adults age, they are likely to remain more comfortable with transportation alternatives such as ridesharing and the technologies that support them. Brewer and Kameswaran (2019) interviewed 16 individuals with visual impairments about their use of rideshare services. Their findings indicated that successfully navigating rideshare services required a complex process of building trust. The role of the driver was critical, as respondents typically relied on the driver to help them with entering and exiting the vehicle safely, providing cues about the trip, and offering orientation upon arrival at the destination.

Examination of Transportation Options

Depending on the community in which one resides, available transportation options will vary. In this section we examine current options available in many communities throughout the United States and the challenges that some riders with vision loss may experience in using these options.

Fixed Route Services

Fixed route services include buses, subways, and ferries. In the Project VISITOR study (O'Day, et al., in preparation), many seniors with low vision reported difficulty using regular bus service, even where it was available in their communities, because the bus stops were not close enough to their home or destination, they had difficulty finding the bus stops, or could not read and understand printed bus schedules. Other participants said buses were not available throughout the service area and had limited days and hours of operation. These findings parallel those of Crudden (2018) who reported that participants said that transit stops may not be marked, drivers may not call out stops, or riders may find the route to reach public transportation unsafe or inaccessible. Almost all of the 81 participants in the Project VISITOR study reported they needed some form of assistance during travel. Assistance was needed to know when the vehicle had arrived for them or at their drop-off point, to travel from the drop-off point to their destination, or to complete tasks at their destination such as locating an office or items in the store (O'Day et al., in preparation).

Paratransit

Per the ADA, public agencies that provide fixed route service are required to provide complementary paratransit services to people who are unable to navigate the public transportation system or unable to get to a point where they can navigate the public transportation system. Paratransit, a form of demand responsive services, are dispatched on request and operate curb-to-curb or door-to-door. Unfortunately, many local paratransit agencies implement policies that significantly limit or negate use of paratransit by riders who are visually impaired. For example, there are often long wait times in applying for paratransit services, which can leave people without transportation for weeks or even months. Currently, paratransit agencies have up to 21 days to determine a person's eligibility for services and then must allow applicants to go through an appeal process if necessary. Because of the waiting period, the law allows agencies up to 51 total days to process an initial application and subsequent appeal. If a person who is blind or has low vision moves to a new community to take a job,

they may have no way of getting to that job for the first 51 days, if not longer, based on when their application to ride paratransit is filed and the timeliness of the agency processing the application.

Though participants across all three geographic groups in the Project VISITOR study reported paratransit services were affordable, they did identify barriers to these services including:

- The need for them to schedule trips in advance.
- Limited days and hours that the service was available.
- The need as a rider to spend considerable time in the vehicle as others were picked up and dropped off.
- The demand for paratransit services in their communities exceeded availability of service.
- The lack of flexibility prohibited them from being spontaneous.
- Challenges in getting where they wanted to go as vehicles were prohibited from crossing into other jurisdictions (O'Day et al., in preparation).

With a few exceptions, paratransit agencies don't allow for rides with stops en route, for instance, to pick up a prescription on the way home from a medical appointment or drop a child off at daycare.

Taxis

Taxis are generally convenient to schedule and use but can be costly. Communities may provide discount vouchers for use of taxis for people with disabilities; however, riders may be limited to the types of trips for which they can use the vouchers (e.g., only medical appointments). Paratransit agencies may subsidize taxi rides to provide on-demand service or to supplement service during high capacity times. Some riders have expressed concern with traveling by taxi as drivers are often not familiar with the needs of riders with vision loss. This is especially true when a rider is accompanied by a guide dog (Brunson, 2015).

Rideshare Services

Uber and Lyft are two examples of rideshare companies. Use of a rideshare service is typically less expensive than taxis. Some seniors with vision loss have reported they do not own or know how to use a smartphone to access rideshare services (O'Day et al., in preparation). Similar to use of taxis, customers are concerned about price and familiarity of drivers in providing rides for people with vision loss. Customers with visual impairments take time to develop trust in the safety of traveling with rideshare services (Brewer & Kameswaran, 2019).

Some paratransit agencies are experimenting with models that subsidize rideshare services to reduce operating costs and offer more flexible service to their passengers. The Massachusetts Bay Transit Authority (MBTA) began its on-demand pilot paratransit project in 2016. Rides may cost as little as $2 and instant same-day booking is available. However, the MBTA clearly states that "Uber, Lyft, and Curb drivers are not required to assist customers in the same way that RIDE [paratransit] drivers are." (Massachusetts Bay Transit Authority [MBTA], n.d.).

In recognition that some seniors, or others, do not own a smartphone or are not comfortable using an app to schedule a rideshare vehicle, companies such as GoGoGrandparent are available. Through these subscription-based services, riders can call a toll-free number and a customer service representative will summon the rideshare vehicle for the subscriber. In addition to paying the fee for the vehicle, the user is charged a fee by the company for hailing the ride.

Private or Community Transportation

In some communities, volunteer driver and/or senior residential transportation programs are available. O'Day et al. (2019, in preparation) reported that these services are often limited in when they are available or the need for them exceeds availability. Further, the study found that of 32 responding agencies that provide services for people with visual impairments, most said they did not know if a particular mode of transportation is available in their community, including senior residential or volunteer driver transportation.

Those with vision loss report they often receive rides from those in their personal network (e.g. family, friends, co-workers). Corn and Rosenblum (Corn & Rosenblum, 2002; Rosenblum & Corn, 2002a, 2002b) reported that almost all their participants had a family member or friend who they routinely asked for rides, yet 25% of the participants felt uncomfortable making such requests. O'Day et al. (in preparation) reported that more than 4 out of 5 of their respondents had a family member or friend who routinely drove them where they needed or wanted to go.

Additionally, friends, family members, and caregivers often do not know where to turn to find transportation options for those with vision loss. No single entity has responsibility for keeping an up-to-date transportation directory and there is no consistent referral system between medical providers, vision rehabilitation agencies, the aging network, and other key players (NADTC, 2018).

Promising Practices

During the course of conducting its review, AFB staff became especially interested in pilot programs that challenge the status quo. Throughout the United States there are pilot programs that are leveraging both technological advances such as smartphone apps and low-tech options to access high-tech methods for scheduling transportation. For example, paratransit riders in Dallas were able to opt into a pilot program using Lyft by calling the paratransit company to schedule a ride while monitoring arrival times and driver information through text messaging (Downtown Dallas, 2017). In Knoxville, Tennessee a pilot project completed in 2015 resulted in the development of an app that enabled older people and people with disabilities to communicate with transit drivers. During the evaluation phase, changes were made to the app to improve its accessibility for people with visual impairments (Community Transportation Association of America [CTAA], n.d.). There is limited data available on the effectiveness of these and other pilot programs.

The Federal Transportation Authority (FTA) Mobility on Demand Sandbox Program allocates funding to communities to conduct research on emerging service options in combination with available technologies that allow for greater individual mobility. The funding provides communities a means to integrate Mobility on Demand (MOD) concepts through local partnerships, demonstrated in real-world settings (National Academies, 2018c). Several of these trial programs are exploring door-to-door services or first/last mile solutions to and from transit stops by partnering with taxi and ridesharing companies.

Shared Ride Partnerships

To address rising costs and improve customer service and satisfaction, paratransit programs began looking to establish partnerships with taxi companies and more recently, rideshare companies. Communities across the U.S. are offering select paratransit riders the opportunity to participate in pilot partnership programs. The pilot programs vary widely in the services they offer, how they offer services, cost to the rider, and who is eligible for the program.

As an example, in 2017, Dallas Area Rapid Transit (DART) paratransit began a pilot program allowing some customers the option to receive rides through a rideshare company. Initial participants were invited by a local agency or could request inclusion in the pilot. DART's program allowed it to fill in service demands during high-capacity times and achieve cost savings. Riders enjoyed the flexibility to request a ride as little as two hours in advance rather than being required to schedule a ride a day or two in advance for the traditional van service (Dallas Downtown, 2017). A visually impaired pilot participant shared, "The pilot program has made my rides to and from work, as well as other places I need to go, much faster, more reliable and much less frustrating because I go directly to my destination" (Personal communication, 2020).

While alternative services must be compliant with the ADA, they are not bound by the service criteria that govern ADA complementary paratransit. There are criteria for when alternative options can be used by a paratransit customer. These include:

1. The decision to use the alternative service is entirely that of the customer.
2. The transit agency can suggest the alternative service option, but the customer may still choose to use the ADA paratransit service.
3. When a customer chooses to use the alternative service there is no impact on the customer's ADA paratransit eligibility or right to continue to request trips on the ADA paratransit service.
4. None of the vehicles used to provide the alternative service are owned, operated, or controlled by the transit agency (National Academies of Sciences, Engineering, and Medicine [National Academies], 2018a).

There are reasons prohibiting public transportation providers from moving ridesharing-paratransit pilots to permanent programs. These include:

1. The public transportation authority must be able to offer the same flexibility (e.g., scheduling a ride as little as two hours ahead instead of the day before) to every paratransit rider, not just those using a rideshare service.
2. Accessible vehicles are not available in every rideshare service market, so paratransit riders using wheelchairs or scooters cannot always take advantage of a rideshare program.
3. Some public transportation providers have not worked out a way for riders to pay for a rideshare service ride. This is especially difficult for those riders who do not use banks (are unbanked).
4. Current regulations require paratransit drivers to have periodic drug and alcohol screenings, and at present, regulations for rideshare service drivers vary widely from state to state and city to city.
5. Disability awareness training, including the rights of riders with service animals, is not as robust or consistent for rideshare service drivers as it is for paratransit drivers, leading to driver insensitivity and ride refusal (National Academies, 2018b).

Transit agencies typically want to evaluate their programs, but few have developed an evaluation plan or have negotiated data sharing with their program's rideshare companies. In a 2019 study of public transportation agencies that are piloting rideshare partnerships, only 27% of 22 transit agencies had developed a formal evaluation process for their partnership. Common evaluation metrics included customer satisfaction surveys, cost per trip analysis, overall cost analysis, and overall ridership. Eighty seven percent of transit agencies relied on rideshare services to collect customer feedback, though in

some cases, companies were hesitant to share data due to concerns about privacy, public records requests, and competition. (National Academies, 2019b).

Ridesharing is available beyond the paratransit framework, as well. Organizations are partnering with rideshare service companies directly to provide transportation to their locations for clients to receive services or attend events. The sponsoring organization is subsidizing the cost of the rides. For example, Lighthouse for the Blind and Visually Impaired in San Francisco was selected to participate in the Uber Community Impact Initiative that provides grants to nonprofits so they can offer rides to help people access services such as healthcare and job training (Lighthouse for the Blind and Visually Impaired, personal communication, November 12, 2019).

Mobility Management

Mobility managers coordinate rides on public transit and other transportation services for older people and people with disabilities. Transportation is managed through a central information hub that assists individuals and their family members with finding and accessing transportation in their communities. Mobility managers may also arrange for rides, mainly through paratransit and bus services, but sometimes filling gaps with options such as volunteer drivers.

Mobility managers leverage a network of community transportation options to facilitate Mobility on Demand that is centered on the needs of the customer. This would suggest that mobility managers should be well versed in the transportation needs unique to people with visual impairments. The program developed by the Wisconsin Association of Mobility Managers is a leader in providing ongoing professional development for mobility managers and offers a mobility management certification program (Birnie, McLary, Grage, & Lynott, 2019).

The broader concept of Mobility as a Service (MaaS) refers to integrating a variety of public and private transportation services to provide end-to-end travel. Typically, a single payment covers all modes of transportation used to complete the trip. Administration of MaaS involves aggregating transportation operators into one platform, similar to the idea behind mobility management. This framework is easiest to implement in urban communities where there are a large number and a variety of transportation providers (Lynott, 2018).

Smaller cities and rural areas face greater challenges in providing MaaS and can benefit greatly from mobility management. In 2018, the Transportation Research Board published a guide to successful mobility management in smaller communities. The guide includes recommendations for gathering data and evaluating program outcomes (National Cooperative Research Program [NCRP], 2018). Yet, many of these mobility management programs operate only as a pilot and must find funding to continue.

Travel Training

Travel training for older people and those with disabilities has been adopted by some transit agencies. Travel training optimally involves one-on-one interactions between the customer and a qualified trainer to address the rider's specific needs. For a person with vision loss, the trainer should be a certified orientation and mobility specialist and familiar with the techniques used by those with visual impairments when accessing public transportation. Travel training programs encourage ridership using conventional public transit services, with lower operating costs than paratransit services. At the same time, confidence in using public transit improves the mobility options and independence of customers using the service.

The National Academies (2014) provided an overview of best and promising practices around travel training. For instance, they emphasized that training should include "information on entering and exiting the transit facility, paying fares, special passes, purchasing tickets, reading schedules, locating seating, planning trips, personal safety, and transferring" (p. 15). Further, program trainers should follow up with participants to monitor use of transit and provide additional training if necessary (Easter Seals Project ACTION, n.d.).

The National Academies (2014) identified Chicago's Regional Transportation Authority (RTA) of Northeastern Illinois travel training program as a model. One of its primary program partners is the Chicago Lighthouse for the Blind. The RTA's free program included information presentations and the option of receiving one-on-one O&M travel training to practice riding buses and trains (Regional Transportation Authority, n.d.).

Transportation Apps

There are a growing number of apps that are enhancing local travel for people with vision loss. Some apps facilitate transportation for everyone, such as the Uber and Lyft rideshare apps. Others are specific to people with vision loss, for example, wayfinding apps Aira and BeMyEyes.

Through their mobile apps, Aira and BeMyEyes use remote assistance by connecting people who are visually impaired with agents (Aira) or volunteers (BeMyEyes). The agent or volunteer describes what is visible through the user's smartphone camera or smart glasses. These services facilitate the user's navigation, access to printed information on signs, operation of kiosks, and identification of objects. Aira can integrate with rideshare apps so the user can book and monitor the trip and receive directions to the vehicle when it arrives. Aira is being tested in partnership with some transit agencies, such as the Massachusetts Bay Transit Authority (MBTA) in Boston (Brooks, 2020).

Access to services such as Aira or BeMyEyes is not available to everyone. Those without a mobile device cannot access the services. While BeMyEyes is a free service with volunteer agents, Aira is available by paid subscription and uses paid agents. Subscription fees are sometimes a hinderance to people using the Aira service. A number of communities, businesses, and transportation systems provide the service free of charge in their areas.

Wayfinding technology uses Bluetooth beacon technology to transmit pre-recorded messages to an app to provide the user location and other important information. The MBTA is participating in a study of an indoor wayfinding system called PERCEPT in their North Station. PERCEPT allows people with visual impairments to independently navigate unfamiliar or complex environments such as those found in a transit station (Massachusetts Department of Transportation [MassDOT], 2019).

Autonomous Vehicles

Autonomous vehicles have the potential to expand access to transportation for those who cannot drive. Assistive technology can be integrated into autonomous vehicles to allow people with vision loss to operate the vehicle without visual access. Accessibility standards, architectures, and practices must be included in the design of autonomous vehicles before these can be considered a viable option for those with vision loss. The ITS America outlines key areas of consideration for people with disabilities utilizing autonomous, driverless vehicles. For people with vision loss, these include:

- The vehicle's interface incorporates equivalent audio and/or other non-visual methods of communication;
- A means of orienting and wayfinding to and from the vehicle is built-in; and
- Warning of obstacles and traffic when entering or exiting a vehicle is provided.

Whether in an autonomous vehicle or a standard vehicle, besides the driving process, there are other tasks that currently require vehicle passengers to use their vision. These tasks range from adjusting temperature and other controls to using maps for navigation. Safety concerns highlight the necessity of receiving quick and clear information so a person with low vision or blindness can respond to an emergency situation when operating an autonomous vehicle (Bayless & Davidson, 2019).

Experiments with integrating autonomous vehicle technology into the transportation network are being demonstrated with projects such as Accessible Olli, a self-driving shuttle bus "designed by people with disabilities, for people with disabilities" (Rubin, 2018). The project was developed as a partnership between CTA Foundation, IBM, and Local Motors. Designers integrated accessibility into Accessible Olli, specifically for those with visual impairments, hearing impairments, physical impairments, and cognitive impairments. One of the unique features that the shuttle provides to a passenger who is visually impaired is the ability to direct the passenger to an empty seat using machine vision to identify open spots and audio cues to direct the passenger (Center on Technology and Disability, n.d.).

Inclusion

A key to any transportation innovation is the inclusion of individuals with vision loss in the planning process. For example, the Maryland Inclusive Transportation Project, with a grant through the National Aging and Disability Transportation Center included the National Federation of the Blind on their transportation planning steering committee. Achievements of the Maryland Inclusive Transportation Project included development and testing of accessible signage for public transit, availability of braille route information, and training transit staff about working with people with disabilities (Maryland Department of Transportation, 2018).

Transit agencies still have a long way to go towards making their services fully accessible. By including people with disabilities in their planning, they are more likely to prioritize the projects needed to realize mobility advances. The 2017 Chicago Transit Authority (CTA) All Stations Accessibility Program plan states that 45 of 145 CTA stations are not currently accessible. It will be another 20 years before the necessary modifications will be completed. This includes the addition of braille signage and wayfinding elements such as tactile ground surface indicators, tactile maps, and wayfinding apps. (Chicago Transit Authority, 2017). The CTA's ADA Advisory Committee members represent people with disabilities, including visual impairments. They provide input on the development and assessment of future CTA projects and services, as well as comment on current services, policies, and practices (Chicago Transit Authority, n.d.).

Recommendations

To improve transportation systems for people with vision loss, AFB suggests the following actions:

1. Include people with vision loss in transportation planning at all levels (e.g., advisory boards, task forces).
2. Solicit feedback from riders with visual impairments when evaluating transportation programs.
3. Modernize paratransit and work toward more passenger-friendly policies and scheduling systems.

4. Enact consistent and coordinated policies at the local, state, and national level to provide services that are accessible across jurisdictions.
5. Ensure door-to-door considerations are included in Mobility as a Service (MaaS) networks to support the needs of people with visual impairments.
6. Ensure mobility managers are fully informed about the needs specific to people with visual impairments and have the necessary resources to meet the needs of those with visual impairments.
7. Review the content of current mobility manager certification programs to ensure they provide best-practice information about passengers with visual impairments and how to meet their unique needs.
8. Improve access to mobility management and invest the resources needed to sustain these programs in the long term.
9. Expand travel training to all transportation systems and promote coordination with orientation and mobility (O&M) services, recognizing that the two are different, yet both are required for a person to safely and confidently navigate the transportation environment.
10. Incorporate accessible design into autonomous vehicles from the beginning. Design must include non-visual access methods for those with significant vision loss.
11. Invest in research that identifies the best transportation solutions to meet the unique needs of people with vision loss in a modern transportation network.
12. Develop consistent criteria to evaluate the effectiveness of transportation options.
13. Include people with visual impairments when designing research studies on transportation programs, to ensure the needs of these riders are represented.
14. Collect data specific to people with vision loss, including pedestrian network accessibility and the use of alternative transportation modes and use the data to inform the development of programs, policies, and legislation.
15. Conduct a large-scale study using a national sample, across multiple methods of travel, to more deeply understand the specific needs of travelers with visual impairments. Findings from the study can guide transportation providers, advocates, policy makers, and other key stakeholders in their work to ensure transportation services meet the needs of those with vision loss.

Looking to the Future

Technology is changing the transportation landscape for people with vision loss. To leverage this trend, AFB is identifying, evaluating, and sharing promising practices, as well as conducting and supporting research to promote evidence-based informed practices that will lead to systems change. The uniqueness of challenges associated with transportation for people with vision loss requires considerably more attention by researchers, policy makers, and organizations supporting people who are visually impaired.

AFB is also partnering with other organizations to advocate for improvements in transportation for people with vision loss. For example, to address inflexibility in the paratransit system, AFB's Public Policy and Research Institute is encouraging paratransit service providers and policy makers to incorporate interim stops for riders. AFB believes programs such as Virginia's Specialized Transit for Arlington Residents (STAR) have strong potential for improving transportation use by those with vision loss. STAR riders are allowed to make up to three stops at childcare facilities en route to a final destination for no additional charge. An Arlington parent who is visually impaired shared, "We are given 10 minutes to drop off or pick up before going to our next destination. This has undoubtedly saved us thousands of dollars in time and transportation costs over the last five years and has been

instrumental in allowing us to schedule around and meet the demands of our jobs and maintain gainful employment" (Cervenka, 2020).

Efficient and affordable transportation systems that fully support people with vision loss are essential to their maintaining independence and employment. Unique challenges are encountered when those with a visual impairment need and want to travel within their local communities. Transportation providers should specifically include people with vision loss in their system plans and program evaluations. Researchers should engage in studies that evaluate programs for promising practices, to facilitate the development of informed best practices that can be adopted across locales. Policymakers should support funding for transportation service enhancement and revisions to outdated regulations that hinder advancements. By working together, improved transportation systems can be built for people with vision loss.

As a respondent to a survey on accessible communities summed it up: "Transportation services should be accessible, affordable and reliable, easy to use and readily available" (American Printing House for the Blind [APH], 2017, p. 11).

About AFB

The mission of the American Foundation for the Blind is to create a world of no limits for people who are blind or visually impaired. We mobilize leaders, advance understanding, and champion impactful policies and practices using research and data.

Since 1921, AFB has been a leader in expanding possibilities for the nearly 25 million Americans living with vision loss. A national nonprofit, we champion access and equality, and stand at the forefront of new technologies and evidence-based advocacy. We address the most pressing needs of people with vision loss and their families, breaking down societal barriers and promoting broad systemic change. Like Helen Keller, AFB's most famous ambassador, we are committed to creating a more equitable world for people with disabilities.

Our mission and vision tell us what we must do to create a world of no limits. Our objectives tell us how to get there. AFB cultivates in-depth knowledge that improves understanding of issues affecting children and adults who are blind or visually impaired, to facilitate meaningful change that fosters equality and inclusion. To achieve this, we:

Conduct Research to Advance Change

AFB collaborates with researchers and educators to better understand the issues facing people who are blind or visually impaired. We use that knowledge to develop evidence-based solutions in areas including education, employment, socio-economic mobility, rehabilitation services, aging and vision loss, healthcare, and technology.

Promote Knowledge and Understanding

We educate policymakers, business leaders, advocates, and the public about the challenges and opportunities that exist for people who are blind or visually impaired. That knowledge influences attitudes, improving acceptance, accessibility, and inclusion.

Shape Policies and Practices

AFB builds and maintains strategic public- and private-sector relationships and networks. Through these partnerships, we drive the adoption of policies and best practices for making workplaces, schools, and communities more welcoming for people who are blind or visually impaired.

We have led the blindness community for nearly a century, paving the way for a world of no limits. Our most important work lies ahead, but we can't do it alone. Find out more at www.afb.org,

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