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RESEARCH ARTICLE

Impacts of disability on daily travel behaviour: A systematic review

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ABSTRACT

While people with disabilities have different travel patterns compared with the general traveller population, such discrepancies are ignored in mainstream travel demand modelling and planning practice. The failure to represent the diverse travel behaviour of people with disabilities leads to inaccurate forecasting and poor decision-making and exacerbates transportation disadvantages. Thus, this systematic review synthesises previous studies of travel behaviours among people with disabilities, differing from people without disabilities, in terms of trip frequency, mode choice, travel time and distance, and barriers.

This review identified 115 peer-reviewed studies of the daily travel patterns of individuals across three categories of disabilities —mobility, cognitive, and sensory. Our review reveals that persons with disabilities make 10–30% fewer trips than those without disabilities, particularly non-work trips. Another significant difference is in travel mode choice—increased uses of public transit and taxi and riding with others and decreased walking and driving among those with disabilities. People with disabilities are prone to utilising slower means of transportation and travelling shorter distances. The quantitative review highlighted a limited considertation of the built environment characteristics and temporal factors as travel behavour predictors.

Further, our qualitative review shows that despite a high level of adaptation, persons with disabilities encounter many barriers in the built environment to their transportation access. The environmental, social, and system barriers make specific modes unavailable to travellers with disabilities, increase travel time, and eventually decrease their trip frequency. This paper provides implications for travel demand modelling and urban and transportation planning and policy that better supports the transportation needs of persons with disabilities.

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1. Introduction

Successful transportation planning begins with estimating accurately how people will travel, i.e. travel demand modelling. Accurate forecasting is key to decision-making regarding transportation infrastructure investment (Hoque, Erhardt, Schmitt, Chen, & Wachs, 2021). The most popular practice is a four-step demand forecasting procedure (McNally, 2007). The four-step demand model consists of trip generation (travel choice), trip distribution (destination choice), modal split (mode choice), and traffic assignment (route choice) in a top-down sequential process (McNally, 2007). In practice, the traditional four-step model largely ignores the presence of people with disabilities. But people with disabilities have different travel patterns compared with more "mobile" travellers (Schmöcker, Quddus, Noland, & Bell, 2005; Duvarci & Yigitcanlar, 2007; Rosenbloom, 2007). And people with disabilities have consistently reported that transportation issues are a crucial major concern in their daily activities (Rosenbloom, 2007).

Given people with disabilities being a significant minority population, an estimated 12.6 percent of the United States population (Erickson, Lee, & Von Schrader, 2021), the failure to represent their travel behaviour leads to inaccurate predictions, poor transportation infrastructure decision making, and transportation-related injustice. A systematic review is needed for both academics and practitioners to comprehensively understand how disability, in addition to other personal factors (e.g. age, socio-demographics), affects travel patterns (Rosenbloom, 2007). Thus, this systematic review synthesises previous studies to understand how daily travel behaviours of people with disabilities differ from people without disabilities in terms of how many trips they make (trip frequency), which mode they use more likely (mode choice), how long it takes (travel time and distance), and travel-related barriers they experience. This paper provides implications for travel demand modelling and urban and transportation planning and policy that better supports the transportation needs of persons with disabilities.

2. Data and methods

This systematic review follows the PRISMA protocol (Moher, Liberati, Tetzlaff, Altman, & Group, 2009; Rudman & Durdle, 2009). Databases searched included Google Scholar, Scopus, and PubMed. Google Scholar was chosen for its wide selection of multidisciplinary articles, and search results were extracted using *Publish or Perish* software (Gehanno, Rollin, & Darmoni, 2013; Harzing, 1997). Scopus and PubMed were chosen because of their inclusion of public health and transportation journals.

To be included in this review study, a primary source needed to address both daily "travel behavior" and "people with disabilities" as a part of the study. For example, a study exclusively about "travel behavior of the elderly" or "job accessibility of people with disabilities" would not be eligible. On the other hand, a study about "travel behaviour of transportation-disadvantaged populations" including low-income people, children, and older adults, as well as people with disabilities, would be eligible. Search terms included "travel behavio(u)r" and "travel patterns." Regarding disabilities, "people (or persons or individuals) with disabilities," "disabled people (or disabled persons or the disabled)," and "impaired people (or persons)" were also used. Because this review focuses on daily travel patterns, studies exclusively focusing on leisure/tourism travel—often involving overnight and long-distance trips—were excluded. Articles had to be published in peer-reviewed journals and available in English. Conference proceedings, thesis/dissertation, or book chapters were excluded. We did not apply any restriction regarding publication date or research design. The literature search was conducted in the first quarter of 2021.

The Boolean search produced 31,110 articles—2,891 from Scopus, 1,757 from PubMed, and 21,661 from Google Scholar. After removing duplicates and verifying both the English availability and peer-reviewed status of the initial results (n = 4,652), the titles and abstracts were reviewed for relevancy, leading to 353 articles selected for further review. The researchers carefully read the full text of all 353 articles to identify the studies' purpose, research questions, methods, participants, setting, independent and dependent variables, results, implications, and future research recommendations. This further examination resulted in a final set of 115 articles (77 quantitative and 39 qualitative studies; one study used mixed-methods—i.e. both quantitative and qualitative methods) that described peer-reviewed research of the daily travel patterns of people with disabilities. These 115 articles are included in the synthesis of this study. Figure 1 shows the data collection process adopted from the PRISMA protocol (Moher et al., 2009; Rudman & Durdle, 2009).

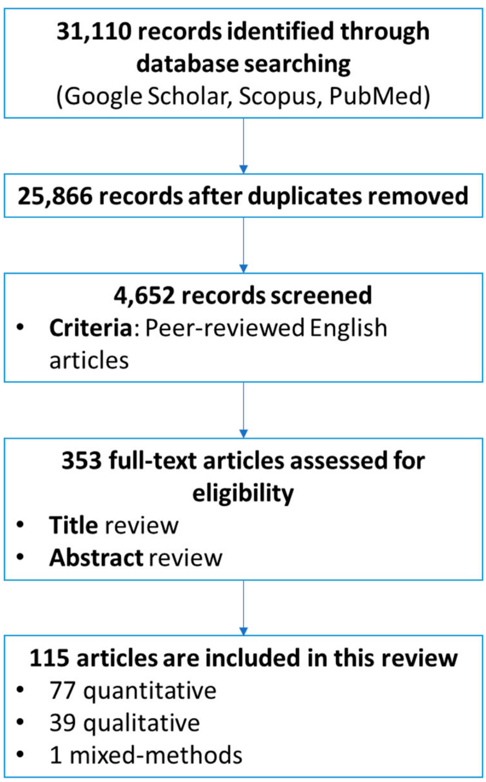

Figure 1. Systematic review process (adapted from PRISMA protocol).

To synthesise the included studies, the research team developed a data extraction sheet, pilot-tested it on ten randomly selected studies, and refined it accordingly. Four researchers completed the extraction sheet (two for quantitative studies and two for qualitative studies) and met to compare the data coding. Disagreements were resolved by discussion. The extracted data consists of three parts—basic information, methods, and findings. Basic information includes the year of publication, study location, research design (qualitative or quantitative), and disability type of the participants (e.g. mobility, sensory, cognitive). Regarding the data and methods, we extracted data sources, sample size, year of data collection, variables (e.g. travel frequency, distance, mode), and modelling approach (e.g. descriptive statistics, regression). Lastly, findings were grouped into trip frequency, travel mode choice (driving, riding transit, walking, etc.), travel time and distance, and other aspects (barriers, socio-demographics, technology).

In terms of types of disability, we used three different disability categories reflecting the focus of the identified studies—mobility, cognitive, and sensory. Mobility disability includes impairments that create limitation in independent, purposeful physical movement of the body or of one or more extremities (Herdman & Kamitsuru, 2017, p. 216). A cognitive disability "refers to problems people have with cognitive functions such as thinking, reasoning, memory or attention" (Roy, 2013, glossary). Delgrange, Burkhardt, and Gyselinck (2020) suggest that cognitive disability encompasses a wide range of disabilities and cannot be specified in a general way either by a device (e.g. a wheelchair, crutches) or a functional disability (e.g. blindness). Sensory disability includes visual and hearing impairments.

3. Results

3.1. Summary statistics of the reviewed studies

Among quantitative studies ($n = 77$), a majority of studies were published after 2011 (59.5%). There are a few studies published before 2000 (6.9%), and five studies were released before 1990. Among the 39 qualitative studies, no articles were published before 2000. Among the 115 articles, North America and Europe have the highest portion of the study sites (82.5%), while few studies were conducted in Asia, Australia, and South America (17.4%). There was no study before 2000 in non-Western countries. This study excludes non-English language articles, which potentially discount several studies from those countries.

Articles are divided into three disability categories (mobility, cognitive, sensory) to examine disparities and similarities in travel behaviour. About 45% (52) of the articles investigated more than one of these disability types. Among the eight studies published before 2000, no study focused on cognitive disability, and only one study examined sensory disability—visually impaired people (Marston, Golledge, & Michael Costanzo, 1997).

In terms of demographic data, five articles (4%) studied children, and 31 studies (27%) focused on elderly people. Other target groups include low-income individuals such as community dwellers (Chudyk et al., 2015; Lubitow, Rainer, & Bassett, 2017) and parents of children with disabilities (Kersten, Coxon, Lee, & Wilson, 2020; Landby, 2019). No studies in our list included children with a cognitive or sensory disability, and only a few studies (6 articles) examined the elderly with these types of disabilities.

There are a variety of different data collection methods applied in the reviewed papers. Questionnaire (including travel diary survey) was the primary tool to collect data in quantitative articles (82% of 77), while the interview was mostly applied in qualitative studies (74% of 39). Other articles collected travel data using GPS devices (Neven et al., 2018), video cameras (Middleton & Byles, 2019), accelerometers (Sengupta et al., 2015), and cellular network-based tracking devices (Borisoff, Ripat, & Chan, 2018).

Among the quantitative studies, many studies (48.1%) used regression models. The other common methodologies used are descriptive statistics (15.5%) and bivariate statistics such as correlations and ANOVA tests (31.1%). Some articles used more advanced analytical approaches such as structural equation modelling (Li & Loo, 2017; Márquez, Poveda, & Vega, 2019; Motte-Baumvol & Bonin, 2018), quasi-experimental design (Benjamin & Price, 2006; Norwood, Eberth, Farrar, Anable, & Ludbrook, 2014), and spatio-temporal analysis (Ferrari, Berlingerio, Calabrese, & Reades, 2014). The sample size ranges vastly from five (Brucker & Rollins, 2019; Brusilovskiy, Klein, & Salzer, 2016) to 1,439,070 (Taylor & Józefowicz, 2012, using US Census' American Community Survey data), with an average of 23,247 and a median of 301, which tends to be larger among quantitative studies (Table 1).

Table 1. Summary statistics of studies (n = 115).

		Number of studies (Percentage)		
	Category	Total	Quantitative Studies	Qualitative Studies
Total		115[a] (100%)	77 (66.9%)	39 (33.9%)
Year	Before 2000	8 (6.9%)	8 (10.3%)	–
	2001–2010	27 (23.4%)	18 (23.4%)	9 (23.1%)
	2011–2020	80 (59.5%)	51 (66.2%)[a]	30 (76.9%)[a]
Location of studies	North America	44 (38.2%)	31 (40.2%)[a]	14 (35.9%)[a]
	Europe	51 (44.3%)	32 (41.5%)	19 (48.7%)
	Others (Asia, Africa South America, Australia)	20 (17.4%)	14 (18.2%)	6 (15.4%)
Disability type	More than one disability type	52 (45.2%)	35 (45.4%)	17 (43.6%)
	Mobility only	40 (34.7%)	30 (38.9%)[a]	11 (28.2%)[a]
	Sensory only — Visual Impairment	13 (11.3%)	7 (9.1%)	6 (15.3%)
	Sensory only — Hearing Impairment	2 (1.3%)	1 (1.3%)	1[b] (2.6%)
	Cognitive only	8 (6.9%)	4 (5.2%)	4 (10.1%)
Target Group	Children only	5 (4.3%)	4 (5.2%)	1 (2.5%)
	Elderly only	31 (26.7%)	22 (28.5%)	9 (23%)
	No demographic restrictions	80 (68.9%)	51 (66.2%)[a]	29 (74.3%)[a]
Data Collection Method	Questionnaire	72 (62.6%)	63 (81.8%)	9 (23.8%)
	Travel Diary Survey	27 (23.5%)	25 (32.4%)	2 (5.1%)
	Interview	59 (51.3%)	31 (40.2%)[a]	29 (74.3%)[a]
	GPS	8 (6.9%)	7 (9.1%)[a]	2 (5.1%)[a]
	Others	20 (17.4%)	16 (20.8%)	4 (10.2%)
Sample size	Mean	23,247.2	34,863.2	23.2
	Median	301	600	30
	Minimum	5	5	5
	Maximum	1,439,070	1,439,070	4,161

[a]Borisoff et al. (2018) is a mixed-methods study using GPS, accelerometers, and interview data in Canada. Thus, it was included in both quantitative and qualitative studies columns.
[b]Hersh (2014) covers both visual and hearing disabilities.

Table 2. Trip frequency/probability differences between people with and without disabilities (note: The "Sample Attributes" column has the following format: disability/age restrictions (none means no restriction); disability types (all means all disability types?are included); sample size; country. Entries are?sorted by publication year).

Ref.	Sample Attributes	People with disabilities	People without disabilities or the whole sample
[1]	Disabled; Mobility; 198; UK	2.2/week (non-work)	-
[2]	65+ or Disabled; All; 10,439; UK	2.37/day (mobility disability has a greater impact than sensory or cognitive one)	2.78/day
[3]	Disabled; Sensory; 64; Japan	11.4/week (travels with no companion decrease as the severity of visual impairment increases)	-
[4]	17-; All; 846; USA	82.2% (probability of traveling 5-7 days a week), 2.6% (probability of not traveling for a week)	79.7% (probability of traveling 5-7 days a week), 1.7% (probability of not traveling for a week)
[5]	60+; Mobility; 543; USA	(health care trips) not significant for the overall sample, but for people who do not drive, trips to routine checkups and emergency care visits were significantly lower among people with disabilities	-
[6]	Disabled; Sensory; 960; UK.	45% (probability of traveling once a day)	-
[7]	18+; Mobility; 218; USA	4.65/week (work), 2.6/week (non- work)	4.57/week (work), 3.25/week (non-work)
[8]	60+; Mobility; 4,268; USA	0.35 fewer trips/day	-
[9]	25+; Sensory; 311; Sweden	Not significant	-
[10]	65+; All; 6,711,986; South Korea	0.65 public transit trips/week	1.58 public transit trips/week
[11]	65+; All; 574; Sweden	10 days/month	26 days/month
[12]	None; Mobility; 75,331; Denmark	20% lower probability of a daily trip (non-work)	-
[13]	60+; Sensory; 116; USA	5.7/week	8.2/week
[14]	None; Mobility, Cognitive; 195,018; UK	10.2/week	14.0/week
[15]	None; Mobility; Sensory; 945; Netherlands	18.0% fewer trips (non-elderly), 30.0% fewer trips (elderly)	3.2/day (non-elderly), 2.9/day (elderly)
[16]	None; Mobility; 123,562; UK	37% (probability of not travelling/day)	14% (probability of not travelling)
[17]	None; All; 12,013; China	1.12/day (work), 1.13/day (non-work)	1.25/day (work), 1.37/day (non-work)
[18]	18+; Mobility; 204,035; USA	Reduced travel among people with mobility restrictions was associated with 1) low household income, 2) being retired or living with children, and 3) homeowners	-
[19]	Disabled; Mobility; 1,035; Canada	2.4/day (spring), 3.4 (summer), 2.1 (fall), 2.2 (winter), 2 vs. 2.75 (with and without snow), 2.1 vs. 2.75 (below and above 0°C),	-
[20]	Disabled; All; 108; Belgium	2.7 - 5.0/day (by severity in Multiple Sclerosis)	-
[21]	None; All; 153,242; USA	3.92/day	4.21/day

(*Continued*)

Table 2. Continued.

Ref.	Sample Attributes	People with disabilities	People without disabilities or the whole sample
[1] Sutton (1990)		[9] Thorslund et al. (2013)	[18] Henning-Smith et al. (2018)
[2] Schmöcker et al. (2005)		[10] Song et al. (2014)	[19] Borisoff et al. (2018)
[3] Shimizu (2009)		[11] Sundling et al. (2014)	[20] Neven et al. (2018)
[4] Wheeler et al. (2009)		[12] Figueroa et al. (2014)	[21] Henly and Brucker (2019)
[5] Mattson (2011)		[13] Sengupta et al. (2015)	
[6] Douglas et al. (2012)		[14] Lucas et al. (2016)	
[7] Jansuwan et al. (2013)		[15] Böcker et al. (2017)	
[8] Boschmann and Brady (2013)		[16] Corran et al. (2018)	
		[17] Ren et al. (2018)	

3.2. People with disabilities' daily travel behaviour: a quantitative synthesis

3.2.1. Trip frequency

People with disabilities are shown to make fewer trips compared to those without disabilities. Table 2 summarises the studies investigating the trip frequency (or the probability of making trips) of people with disabilities. Studies have shown that the trip frequency of people with disabilities ranges between 5.7 and 10.2 per week while those without disabilities make between 7.8 and 14.0 per week, indicating that disability is related to approximately 2–4 fewer trips per week or about 30% reduction. When measured daily, people with disabilities have 2.0–3.9 trips per day, while the average trips for the general population are 2.6–4.2 trips per day, showing that disability is associated with a 10–20% trip reduction per day. We did not find a noticeable longitudinal trend among the studies, probably because most were recently published.

Differences in trip frequency between people with and without disabilities are more significant in non-work trips than work trips. Schmöcker et al. (2005) report that walking difficulties, hearing and sight impairments, and cognitive disabilities negatively affected the frequency of non-work trips. Jansuwan, Christensen, and Chen (2013) show that people with disabilities made 2.6 non-work trips per week while the general population made 3.3 non-work trips per week, and work trips were not different between the two groups. Regarding healthcare trips, Mattson (2011) shows that among people who do not drive, those with disabilities had significantly fewer routine visits (0.28 times fewer) and emergency care visits (0.27 times fewer) than those without disabilities. Reviewed studies indicate that people with disabilities have approximately 25% fewer trips in all categories of trips except for working trips and visiting family/friends trips.

Several studies have confirmed the negative association of disability severity with trip frequency. For instance, Neven et al. (2018) showed that increasing ambulatory dysfunction decreases the trip frequency from 4.2–1.8 trips per day. Shimizu (2009) reported that with an increase in the severity of visual impairment, the frequency of trips with no companion decreases while the frequency of trips accompanied by individuals without disabilities increases.

Concerning the environmental and temporal factors, Borisoff et al. (2018) show that individuals with mobility disabilities made more daily trips during the summer (3.4 trips/day vs. 2.2 for non-summer seasons), non-snowy days, (2.75 vs. 2 otherwise), and daily temperature above 0– (2.75 vs. 2.1 otherwise). Metropolitan residents with travel-limiting health conditions were 0.97 times less likely to travel than non-metropolitan residents (Henning-Smith, Evenson, Kozhimannil, & Moscovice, 2018).

Our review identifies some gaps that need to be addressed. First, only a limited number of studies have investigated the impact of built environmental factors on travel behaviour of people with disabilities. There are several factors to be considered, such as the density of an area that might change the travel behaviour of people with disabilities, as shown in experimental studies (Gaire, Song, Christensen, Sharifi, & Chen, 2018; Sharifi, Christensen, Chen, & Song, 2019; Sharifi, Song, Esfahani, & Christensen, 2020; Stuart et al., 2019). Second, the impacts of temporal factors and events (e.g. seasons, weather events, air pollution) on travel behaviours of people with disabilities are essential to understand their needs better (Borisoff et al., 2018).

3.2.2. Mode choice

Another significant difference between people with disabilities and their non-disabled counterparts is in travel mode choice. Certain types of disabilities prevent travellers from engaging in active modes of transportation; other types can make personal cars impossible. Table 3 summarises the mode utilisation of people with disabilities.

Studies revealed a wide range of values (between 4.6% and 51.0%) for the percentage of people with disabilities who used public transportation (Bezyak, Sabella, & Gattis, 2017; Douglas, Pavey, Corcoran, & Clements, 2012). Among all the means of public transportation, buses are the most widely used, with a maximum of 74% of individuals using them for their trips (Bezyak et al., 2017). Paratransit services are the second most popular type of service, with 0.9%–30.2% of the population relying on them (Crudden, McDonnall, & Hierholzer, 2015; Deka, 2014). Using taxis has a prevalence of up to 40.7% (Márquez et al., 2019).

Walking was also part of the utilised mores of transportation among disabled individuals. Studies have reported that 3.0% to 46.0% of individuals may use walking (Douglas et al., 2012; Jansuwan et al., 2013).

Furthermore, driving is also an essential mode of transportation for people with disabilities. The prevalence of driving personal vehicles ranges between 2.6% and 82.7% on average (Brucker & Rollins, 2019; Crudden et al., 2015), rendering it as one of the main modes of transportation. But it should be noted that the wide range of this mode's utilisation shows that not all the targeted individuals in different societies had equal access to private vehicles. Other modes utilised by people with disabilities are "riding with others" with a utilisation rate of 5.9%–46.7% (Samuel, Ademola, & Onimisi, 2018; Viljanen, Mikkola, Rantakokko, Portegijs, & Rantanen, 2016) and "biking" with a utilisation rate of 0.8%–2.2% (Lucas, Bates, Moore, & Carrasco, 2016; Taylor & Józefowicz, 2012).

As a comparison, the average modal split of the general population included in this review is as follows: walking with a utilisation rate of 11.3%–52.3%, driving with the utilisation rate of 23.3%–85.7%, riding with others with a utilisation rate of 11.6%–26.6%, public transportation with the utilisation rate of 4.3%–34.8%, taking a taxi with the utilisation rate of 0.1%–2.1%, and biking with the utilisation rate of 1.2%–38%. Comparing these values with the values obtained for individuals with disabilities reveals that disability is associated with increased riding public transit, riding with others, and riding a taxi while decreasing walking, driving, and biking.

Table 3. Mode utilisation of people with disabilities (note: The "Sample Attributes" column has the following format: disability/age restrictions (none means no restriction); disability types (all means all disability types are included); sample size; country. Entries are sorted by publication year).

Ref.	Sample Attributes	Walking	Car	Public transportation	Taxi	Other modes	Notes
[1]	Disabled; All; 3,202; USA	–	36.4 (driving); 27.6 (riding with others)	0.16	–	12.1 (paratransit)	–
[2]	Disabled; Mobility; 198; UK	–	–	–	28.6	56.0 (paratransit)	A survey of paratransit riders
[3]	13–16; Cognitive; 27; Australia	21	37 (riding with others)	21	–	26 (biking; PwoD: 38)	School commuting mode only
[4]	Disabled; All; 777; Sweden	–	77.0 (driving); 13.0 (riding with others)	–	–	–	A survey of persons with disabilities driving adapted cars
[5]	60+; Disabled; Sensory; 66; Scotland	19.3	27.3	36.5	19	17.2 (paratransit)	–
[6]	65+; All; 10,439; UK	40.4 (disability ⇒ higher probability of walking)	18.7 (driving),12.1 (riding with others)	28.3 (disability ⇒ a lower probability of transit use)	0.5	–	The sample includes older adults (65+) and younger adults with travel-limiting conditions
[7]	60+; All; 6,406; UK	PwDs are more likely to walk than driving	PwDs are more likely to ride with others than driving	PwDs are more likely to ride public transit than driving	–	–	People with travel-related disabilities make fewer complex trips
[8]	17-; All; 846; USA	–	34.2(PwoD: 54.2)	50.7(PwoD: 34.8)	–	3.3% (paratransit)	School commuting mode only
[9]	Disabled; Sensory; 64; Japan	33	27	35	4	1 (bicycle)	
[10]	None; Mobility; 732; Netherlands	No significant differences with PwD (PwoD: 16%)	A higher likelihood of riding with others (PwoD: 48% driving, 11% riding with others)	-	–	No significant differences with PwD (PwoD: 26% bicycle)	Social interaction travels only
[11]	60+; Mobility; 543; USA	–	73% (driving; PwoD: 89%)	0.11(PwoD: 5%)	–	–	Health care trips only
[12]	None; Mobility; 600; Poland	24.1(PwoD: 52.3)	17.7 (driving; PwoD: 23.3); 31.5 (riding with others; PwoD: 11.6)	20.3 (PwoD: 10.5)	4.3 (PwoD: 1.2)	2.2 (biking; PwoD: 1.2)	Trips to healthcare facilities only
[13]	Disabled; Sensory; 960; UK	46	56	51	25	–	Respondents could choose multiple modes of transportation
[14]	18+; Mobility; 218; USA	3 (including bicycle)	15 (driving); 23 (riding with others)	30	–	16 (paratransit); 13 (social volunteer service)	–

[15]	None; Mobility, cognitive; 60; Belgium	0–15.0 (PwoD: 19.8)(including bicycle)	12.0–66.5 (driving; PwoD: 62.3); 18.5–54.2 (riding with others; PwoD: 13.7)	0–5.2(PwoD: 4.3)	0	0.0–16.4 (adapted transport; PwoD: 0)	Range indicates the severity of Multiple Sclerosis (mild/moderate/severe)
[16]	25+; Sensory; 311; Sweden	29.39	16.41 (driving), 9.57 (riding with others)	18.78	–	–	The degree of hearing loss did not affect the frequency of each mode of transportation
[17]	Disabled; Mobility; 308,901; USA	12.0 (including bicycle)	49.8 (driving); 32.0 (riding with others)	4.6	0.8	0.9 (paratransit)	From the 2009 National Household Travel Survey (weighted)
[18]	9–14; Disabled; Mobility; 11; Canada	20	72	8	–	–	–
[19]	60+; Mobility; 150; Canada	38	41	17	–	4.0 (bike or taxi)	
[20]	Disabled; Sensory; 492; USA	25	2.6 (driving); 30.9 (riding with others): 18.2 (family members), 6.8 (Volunteer drivers), 5.9 (Carpools)	41.9	11.4 (Taxi), 4.9 (Hired driver)	30.2 (paratransit), 0.7 (bicycle)	Commuting trips only; Respondents could choose multiple modes of transportation
[21]	Disabled; Mobility (functional); 206; Nigeria	48.5	–	–	–	47.0 (wheelchair or similar); 8.8 (crawling)	Commuting trips only
[22]	75+; Mobility; 848; Finland	–	14.0 (driving; PwoD: 48.8); 46.7 (riding with others; PwoD: 22.8)	14.5 (PwoD: 22.9)	14.9 (PwoD: 2.1)	–	Community-dwelling residents
[23]	None; Mobility, cognitive; 195,018; UK	8 (PwoD: 11.3)	46.6 (driving; PwoD: 47.9); 27.1 (riding with others; PwoD: 26.6)	11.5 (PwoD: 9.9)	3 (PwoD: 1.2)	0.8 (biking; PwoD: 1.7)	From 2002–2010 UK National Travel Survey
[24]	65+; Mobility, Sensory; 945; Netherlands	Elderly with disabilities walk less	Elderly with disabilities are more dependent on the car	Elderly with disabilities use public transit less			There were no significant differences in any mode choice between PwDs and PwoDs for non-elderly groups.
[25]	Disabled; All; 4,161; USA	–	–	36.7% (among them, 74.0% use bus, 35.6% paratransit, 28.9%	–	13.7% (exclusively paratransit); 36.1% (used paratransit	Respondents could choose multiple modes of transportation

(Continued)

Table 3. Continued.

Ref.	Sample Attributes	Walking	Car	Public transportation	Taxi	Other modes	Notes
				taxi, 21.2% light rail, 19.5% subways)		once or more last year)	
[26]	Disabled; Mobility, Sensory; 203; Nigeria	37.9	6.9 (driving); 5.9 (riding with others)	8.8	2	3.9 (paratransit), 1.5 (bicycle), 33.0 (tricycle)	
[27]	None; All; 12,013; China	16.6 (PwoD: 12.7)	11 (PwoD: 38.5)	44.3 (PwoD: 7)	–	5.7 (paratransit); 5.8 (bike; PwoD: 8.7)	
[28]	None; All; 1,439,070; USA	–	82.65 (PwoD: 85.68)	5.53 (PwoD: 5.11)	0.29 (PwoD: 0.14)	–	Commuting trips only; From the 2016 American Community Survey
[29]	Disabled; Mobility; 150; Colombia	16.7	16.7	26	40.7	–	
[30]	None; Mobility; 153,242; USA	–	–	14.4	4.2	–	For those with a mobility disability, 44.3% asked others for rides, 21.6% gave up driving, 14.4% reduced public transit use, and 12.4% used specialised transportation services

Pwd: people with disabilities; pwoD: people without disabilities

[1] Bonham (1989)
[2] Sutton (1990)
[3] Pretty, Rapley, and Bramston (2002)
[4] Henriksson and Peters (2004)
[5] Montarzino et al. (2007)
[6] Schmöcker, Quddus, Noland, and Bell (2008)
[7] Su and Bell (2009)
[8] Wheeler et al. (2009)
[9] Shimizu (2009)
[10] Van den Berg, Arentze, and Timmermans (2011)
[11] Mattson (2011)
[12] Taylor and Józefowicz (2012)
[13] Douglas et al. (2012)
[14] Jansuwan et al. (2013)
[15] Neven et al. (2013)
[16] Thorslund et al. (2013)
[17] Deka (2014)
[18] Sean T. Doherty, McKeever, Aslam, Stephens, and Yantzi (2014)
[19] Chudyk et al. (2015)
[20] Crudden et al. (2015)
[21] Bombom and Abdullahi (2016)
[22] Viljanen et al. (2016)
[23] Lucas et al. (2016)
[24] Böcker et al. (2017)
[25] Bezyak et al. (2017)
[26] Samuel et al. (2018)
[27] Ren et al. (2018)
[28] Brucker and Rollins (2019)
[29] Márquez et al. (2019)
[30] Henly and Brucker (2019)

Additionally, disability severity is also an essential factor in mode choice. Studies demonstrated that riding with others is the only mode that increases with the increase in disability severity (Neven et al., 2013, 2018). Additionally, younger adults with disabilities most often ride buses to and from school, while those without disabilities most often drive personal cars (Wheeler, Yang, & Xiang, 2009). Conversely, in the older population of people with disabilities, disabled people usually walk less and use public transport less, while being more often dependent on the car and driving with others than the general population of elderly (Böcker, van Amen, & Helbich, 2017; Douglas et al., 2012; Su & Bell, 2009).

3.2.3. Travel time and travel distance

People with disabilities are prone to utilising slower means of transportation, such as buses, instead of private vehicles. They also have a different travel range as some are restricted to their homes. Several studies investigated travel time and travel distance of people with disabilities (see Table 4).

Generally, people with disabilities experience longer travel times (Benjamin & Price, 2006; Brög & Ribbeck, 1985; Brucker & Rollins, 2016; Taylor & Józefowicz, 2012). The average travel time for work-related trips is significantly higher for disabled individuals, ranging between 21.0 and 31.7 min (Jansuwan et al., 2013; Taylor & Józefowicz, 2012), compared to non-disabled individuals, ranging between 25.0 and 27.4 min (Brucker & Rollins, 2019; Lucas et al., 2016). Jansuwan et al. (2013) also show such a discrepancy for non-work-related trips: 47.9 min for people with disabilities, compared to 35.7 min among their non-disabled counterparts.

Although travel times of people with disabilities are greater than those of individuals without disabilities, their travel distances are significantly shorter (Brucker & Rollins, 2016; Shoval et al., 2011). Studies show that people with disabilities have an average travel distance of 1.6–10.5 kilometres, while this average for individuals without disabilities is 9.0–14.6 kilometres (Lucas et al., 2016; Montarzino et al., 2007; Neven et al., 2013).

Demographic and temporal variables also influence travel time and distance. The mean trip distances decrease with age except for recreational trips that increase at least until about age 80 (Schmöcker et al., 2005). With the increase in the severity of disabilities, the frequency of very short-range trips (less than 0.5 km) and medium-range trips (between 10 and 50 km) increases while the frequency of short-range trips (between 0.5 and 10 km) and long-haul trips (greater than 50 km) decreases significantly (Neven et al., 2013). Regarding the temporal variables, about half (42%) of the journeys took more than 20 min on weekdays while almost two-thirds (63%) took more than 20 min on weekends, indicating that weekend trips are the longest (Falkmer & Gregersen, 2001).

3.3. Barriers of people with disabilities' daily travel behaviour: A qualitative synthesis

3.3.1. Built environment factors

Many studies examined access for whole trips, including the first-mile and last-mile (FMLM), a concept referring to the distance travelled before and after using a transit system (Mo, Shen, & Zhao, 2018; Mohiuddin, 2021). Despite a high level of adaptation to circumstances by the participants, they discussed many barriers in the built environment or "out of vehicle" environment (Meyers, Anderson, Miller, Shipp, & Hoenig, 2002;

Table 4. Travel time and travel distance-related studies (note: The "Sample Attributes" column has the following format: disability/age restrictions (none means no restriction); disability types (all means all disability types are included); sample size; country. Entries are sorted by publication year).

Ref.	Sample Attributes	Travel time (minute)		Travel distance (kilometre)		Note
		Disabled	Overall	Disabled	Overall	
[1]	Disabled & 18+; Mobility; 66,000; Germany	26.3/trip	–	–	–	
[2]	None; Mobility; Cognitive; 407; USA	–	–	9% travel 16 + km per week, 67% travel less than 10 km per week	–	Paratransit travel only; More paratransit uses among those with mental disability than with physical disability
[3]	Disabled; Mobility; 198; UK	–	–	60% travel less than 6.4 km per trip,~30% travel less than 1.6 km	–	Paratransit travel only
[4]	Disabled & 2–16; All; 1060; Switzerland	42% weekday took over 20 min (63% for the weekend)	–	–	–	Parents of children with disabilities; On weekdays,2% did not travel at all, and at weekends 9% did not travel at all
[5]	65 + or Disabled; All; 10,439; UK	8% shorter distance among people with walking difficulties	–	–	–	Sight, hearing, and cognitive disabilities have no negative impact on trip distances
[6]	Disabled & 60+; Sensory; 66; Scotland	76.2% walk less than 30 min	–	86% walk less than 1 mile (1.6 km)	–	Age, safety, and crossing facilities are determinant factors in the walking distance among visually impaired people
[7]	Disabled; All; ~20,000; Canada	–	–	n.s. (except for being very severely disabled)	–	
[8]	60+; Cognitive; 41; Israel	–	–	17.9–772.9/hour (mild cognitive impairment);21.3–313.4 (mild dementia)	20.1–1,496.9/ hour	Range indicates varying travel distances by the hour for one day (24 h); Healthy participants display greater variability in their travel distances
[9]	None; Mobility; 732; Netherlands	–	–	n.s.	11.49/trip	Social trips only
[10]	None; Mobility; 600; Poland	21	–	–	–	Trips to healthcare facilities only
[11]	18+; Mobility; 218; USA	31.7 (work); 47.9 (non-work)	–	–	–	
[12]	None; Mobility, Cognitive; 60; Belgium			9.4/13.1/13.1 per trip (mild/moderate/ severe MS)	9	Patients with Multiple Sclerosis (MS)
[13]	60+; Sensory; 116; USA	–	–	2,930 steps per day (median); A multivariate model shows 18% fewer walking steps for AMD patients	5,960 steps per day (median)	Patients with age-related macular degeneration (AMD); 3.0 moderate-to-vigorous activity minutes/day (AMD) vs. 17.1 min/day (PwoD)

[14]	16+; Mobility; 18,539; USA	Longer travel times to access medical care (OR: 1.43)	–	More likely shorter distance in urban areas (OR: 0.73)	–	Routine medical care trips only; From the 2009 National Household Travel Survey
[15]	None; Mobility, Cognitive; 195,018; UK	23.7	25.1	10.5/trip(median: 4.7)	14.6/trip (median: 4.8)	From 2002–2010 UK National Travel Survey
[16]	Disabled; Mobility; 49; Canada	–	–	2.00/day(median: 1.43)	–	
[17]	18–64; All; 1,439,070; USA	27.37 (work); Disability was not related to a longer commute time	27.40 (work)	–	–	From 2016 American Community Survey

n.s.: statistically not significant.

PwoD: people without disability

[1] Brög and Ribbeck (1985)
[2] Starks (1986)
[3] Sutton (1990)
[4] Falkmer and Gregersen (2001)
[5] Schmöcker et al. (2005)
[6] Montarzino et al. (2007)
[7] Farber and Páez (2010)
[8] Shoval et al. (2011)
[9] Van den Berg et al. (2011)
[10] Taylor and Józefowicz (2012)
[11] Jansuwan et al. (2013)
[12] Neven et al. (2013)
[13] Sengupta et al. (2015)
[14] Brucker and Rollins (2016b)
[15] Lucas et al. (2016)
[16] Sakakibara, Routhier, and Miller (2017)
[17] Brucker and Rollins (2019)

Murphy, Cooney, Shea, & Casey, 2009). Out of vehicle features that negatively affected FMLM travel included uneven surfaces, long walking distances to transit stops, and inaccessible or limited destinations (Faber & van Lierop, 2020; Gaber & Gaber, 2002; Meyers et al., 2002; Naami, 2019; O'Neill & O'Mahony, 2005; Sabella & Bezyak, 2019; Velho, 2019). These barriers affected the way people with disabilities travel by changing, delaying, and cancelling trips or trip modes. In Carlsson (2004), participants with visual impairments noted "irregularities" and changes in floor surfaces increased negative experiences with transit, including issues of falling. Participants chose not travelling to particular destinations due to design choices such as the paving stones used or certain seat designs, though lack of seating altogether made participants hesitant to make certain trips that required further walking distance or longer waits at stops (Carlsson, 2004; Faber & van Lierop, 2020; Naami, 2019; O'Neill & O'Mahony, 2005).

Issues with on-vehicle access, including steps, a lack of deployed ramps for boarding and alighting, bridging gaps from curbs and platforms to transit, and inaccessibility inside the vehicles, added difficulty to a trip (Gaber & Gaber, 2002). For some, the challenges of navigating inaccessible public transit changed travel patterns. In Landby (2019), some families of children with cerebral palsy stopped using public transit either when their child was born or once their child became too heavy to lift due to lack of consistent access features that minimised the need to lift or transfer their child.

While many transit stations have design elements to increase accessibility, in some cases, design elements meant to increase accessibility can also create barriers. Studies listed features such as escalators, elevators, and kneeling buses as potential barriers to mobility. The frequency of breakdowns, lack of maintenance, or other reoccurring issues created difficulty for disabled riders attempting to use these features (Bezyak et al., 2017; Laliberte Rudman et al., 2016; Sundling, 2015; Sundling et al., 2015; Velho, 2019). The unreliability of certain aspects of the built environment and out-of-vehicle travel experience increases anxiety and distrust in the use of the systems (Bezyak et al., 2017; Laliberte Rudman et al., 2016; Sundling, 2015; Sundling et al., 2015; Velho, 2019). It also creates potentially dangerous situations, such as riding an escalator in a wheelchair when elevators are down, which one study participant learned to do as a "skill" for successful travel while using a wheelchair (Velho, 2019). This solution has resulted in death in more than one case (Roby, 2018). In Velho (2019), all 27 of the wheelchair users noted built environment barriers; for example, they showed greater upset at stations that were said to be accessible but were not.

3.3.2. Differences among trip modes

While the majority of studies reviewed focused on the use of buses and trains, as well as walking at various points of the trip, additional modes were studied to a lesser extent. Private cars, taxis, and paratransit were among the modes not as extensively covered in the literature. While paratransit may seem like a clear solution to accessible transit needs, Bezyak et al. (2017) found that paratransit users encountered many barriers to effective use across disability types. People with mental illness reported more issues keeping paratransit eligibility. Visually impaired respondents showed higher instances of missed paratransit pickup windows, and those with mobility disabilities had more significant challenges in scheduling paratransit services (Bezyak et al., 2017). Their paper further suggests that many of these barriers may be the result of underfunded and understaffed paratransit services that influence long ride times, missed pickups, and scheduling issues. Focus groups in Gaber and Gaber (2002) ranked cost, limited-service areas, travelling with children, and hours of operation as primary concerns for their use of the local handi-bus.

Where private cars were an option, loss or inability to acquire a driver's license and concerns about interactions with police, and pedestrians, also made private vehicles less usable for some. For some, cars require costly adaptions to be usable inside the vehicle. Cost was also a factor in the use of rideshares as a mode of transportation (Gaber & Gaber, 2002; Kersten et al., 2020; Landby, 2019; Sundling et al., 2015). For others, relying on a driver in order to use private vehicles came with potential limitations to independence and social life (Wong, 2018)

Finally, several studies found that walking was a major component of travel planning for people with disabilities (Faber & van Lierop, 2020). But unsafe pedestrian spaces, lack of accessible paths, and distance to public transit acts as barriers to mobility. In Murphy et al. (2009), participants noted the difficulty of getting to shops when one doesn't drive and the higher level of planning and effort required. Environmental design factors that impact travel (e.g. elevation, crosswalks, rights of way, distance to destinations) become a hindrance to spontaneity, independence, and freedom of mobility that is a fundamental part of social inclusion and quality of life (Feldman, Wilton, & Fudge Schormans, 2020; Montarzino et al., 2007; Murphy et al., 2009).

3.3.3. Personal and social factors

Personal and social factors also affected travel behaviour. Fear of falling and colliding with other passengers, fear of treatment by other passengers and staff, and constraints on personal capability such as stamina and strength hindered individuals' travel (Bezyak et al., 2017; Carlsson, 2004; Meyers et al., 2002; Nordbakke, 2013; Sammer et al., 2012; Sundling, 2015; Velho, 2019). Participants in several studies noted the perceived level of independence as a factor in their travel behaviour. It is important to note that those perceptions are not always internal. Montarzino et al. (2007) noted that factors such as poorly designed, busy junctions might decrease feelings of independence, while familiarity with space might increase independence for a traveller.

The attitudes of staff, drivers, and other passengers were repeatedly mentioned throughout various studies as being a hindrance to mobility. Negative interpersonal interactions with other transit users and staff have a major impact on the feelings of confidence, independence, security, and anxiety of transit users (Brouwer, Sadlo, Winding, & Hanneman, 2008; Faber & van Lierop, 2020; Feldman et al., 2020; Kersten et al., 2020; Laliberte Rudman et al., 2016; Lamont, Kenyon, & Lyons, 2013; Lubitow et al., 2017; Marr, 2015; Middleton & Byles, 2019; Montarzino et al., 2007; Rose, Witten, & Mccreanor, 2009; Sundling, 2015). In Middleton and Byles (2019)'s study on mobility of people with visual impairments, participants noted feeling "tense," "anxious" and rushed. These feelings created increased pressure on the participants to interact with their surroundings in a specific way or at a specific pace. Participants who used public transit noted many instances of racism by other people they interacted with during a trip, whether staff or riders (Lubitow et al., 2017). In another study, many women who were unable to drive due to age or disability had worries about how they would be perceived by other passengers (Nordbakke, 2013). One woman who did not drive, said she didn't want to be considered a “parasite” to other passengers who would judge her for not riding earlier in the day when the bus was less busy (Nordbakke, 2013).

While the perceptions of the attitudes of the general public are beyond the influence of this work, studies propose solutions to these intangible barriers (e.g. safety, fear, and perception of helpfulness by staff and riders) through design, guidelines, and policies, such as increased lighting at bus stops, robust training for staff, accessible wayfinding and increased consistency and reliability of transit services (Bezyak et al., 2017; Bigby et al., 2019; Hersh, 2013; Rose et al., 2009; Sundling et al., 2015).

3.3.4. Technology access and systems factors

While assistive technology was often discussed and used to help people with disabilities be more mobile (Hersh, 2014; Menninger & Werly, 2014), sometimes technology was the barrier that prevented mobility. Technology—particularly access to information—was often a barrier to full use of transportation for people with disabilities. It was especially impactful for those with visual impairments and some cognitive disabilities who often were unable to locate and use ticketing machines, websites, and apps to access necessary travel information. The complexity of information such as timetables and routes, cost, and purchasing methods excluded some travellers with disabilities from transit, sometimes discouraging trips altogether (Bigby et al., 2019; Marr, 2015; Rose et al., 2009; Visnes Øksenholt & Aarhaug, 2018; Wong, 2018). Additionally, the inability to use or buy a smartphone created additional barriers to information and ticket purchasing.

Transferring between transport modes negatively impacts the accessibility of the trip as a whole (Carlsson, 2004; Faber & van Lierop, 2020; Murphy et al., 2009; Sabella & Bezyak, 2019; Sundling et al., 2015; Visnes Øksenholt & Aarhaug, 2018). In Visnes Øksenholt and Aarhaug (2018), participants noted that difficulty in aligning one mode of transportation’s limitations with another was a larger barrier to mobility than getting to an initial first leg.

The cost was also a systems factor. Marr (2015) noted that users of specialised ride services, particularly in rural areas, were commonly prevented from taking trips due to the cost of the ride. In Lubitow et al. (2017)’s focus groups of transit-dependent riders, participants noted that they worried about increased costs in public transportation as it is already unaffordable. Participants noted having to pick and choose between which trips they could take or take measures such as using money from a child’s piggy bank in order to complete trips that were necessary. For others, options like a taxi were able to address the gaps in public transportation, but only with acceptance of the additional cost. One mother paid $100 for an accessible taxi which she then had to struggle to make up to take her daughter to a camp outside city limits (Sitter & Mitchell, 2019). These factors create experiences for people with disabilities that can hinder mobility regardless of immediate access to transportation.

4. Discussion and conclusions

4.1. Summary of findings

This systematic review synthesises previous studies to understand how daily travel behaviours of people with disabilities differ from people without disabilities. The identified studies were categorised by quantitative or qualitative methods. The quantitative studies most often employed a travel diary survey (questionnaire) to collect data, while the qualitative studies employed interviews. The primary distinction between the two types of studies is in the analysis methods employed. The quantitative studies employed more narrow statistical methods, while the qualitative studies employed broader narrative interpretations. The quantitatively examined studies revealed differences in daily travel behaviours (e.g. trip frequency, mode choice, travel time and distance), and the qualitatively examined studies revealed the barriers and mechanisms behind these differences. Ultimately, the two approaches to understanding the daily travel behaviours of people with disabilities can be confirmatory and complementary. Together these studies reveal the distinct lived experience of daily travel among people with disabilities.

Our review highlights a significant discrepancy in daily travel behaviour between people with and without disabilities. Compared with their more mobile counterparts, people with disabilities make fewer trips (10–30%), which take a longer time and cover shorter distances. Such differences are more discernible in non-work-related trips. The severity of disability and age (particularly being an older adult) affect those travel outcomes more negatively. In terms of travel mode choice, people with disabilities drive less and walk less and use other modes more, including riding with others, public transit, paratransit, and taxi.

These distinctions rise from specific barriers and mechanisms of travel adjustments by people with disabilities revealed by the literature. Lack of accessibility is a major barrier across the whole travel journey, including in-vehicle, out-of-vehicle, and transfer experiences. Negative experiences with staff and passengers resulted in the decreased, alternative, or even cancelled trips by people with disabilities. Frustration with systems includes unreliability of transit service (e.g. long waiting time), maintenance issues, difficulty scheduling paratransit, and lack of access to technology and information. Those system factors made some transit systems less usable, particularly for people with visual and cognitive impairments. A higher cost related to personal vehicles, taxis, and rideshares also plays a negative role. The environmental, social, and system barriers make specific modes unavailable to travellers with disabilities, increase travel time, and eventually decrease their trip frequency. Mentally, those barriers reduce their perception of spontaneity, independence, and freedom of mobility. These negative experiences with daily travel and community living can ultimately lower social inclusion and the quality of life.

4.2. Recommendations for future research

This systematic review also shows that gaps still exist in the body of literature on people with disabilities' daily travel behaviour. Despite the importance of the built environment on travel behaviour (Ewing & Cervero, 2010), we find limited evidence of how the urban form factors change trip frequency, mode choice, travel time and distance among people with disabilities. Given the trend to incorporate land use characteristics (e.g. density, land use mix, destination accessibility) into travel demand modelling (Park, Sabouri, Lyons, Tian, & Ewing, 2020; Tian, Park, & Ewing, 2019), it is urgent to examine different elasticities of travel demand to the built environment variables among the disadvantaged populations.

Second, we need more evidence regarding the impacts of temporal factors and events (e.g. seasons, weather events, air pollution) on travel behaviours of people with disabilities. For example, Borisoff et al. (2018) found significant seasonal variance in trip rates for people with disability, and future research could develop a season-dependent model. During the COVID-19 pandemic, people with disabilities experience double jeopardy—more severe COVID-19-related risks and reduced social activities as well as "everyday emergencies" they have already experienced socioeconomically and physically (Park et al., 2022). It is becoming more critical to understand the resilience of vulnerable groups to disruptive events (e.g. climate change, pandemic, natural disasters).

Another gap is that qualitative studies of travel barriers are concentrated on public transit such as bus and rail. We need a better understanding of how people with disabilities experience a travel journey involving private vehicles, taxis (including ride-hailing), paratransit, walking, or a combination of multiple modes. Such a study would view someone's travel through the concept of a trip chain, a sequence of trips that begins and ends at home, also known as a home-to-home loop, instead of a single trip with one particular mode of transportation (Daisy, Millward, & Liu, 2018; Frank, Bradley, Kavage, Chapman, & Lawton, 2008).

4.3. Implications for transportation planning and policymaking

The behavioural differences observed among travellers with disabilities can result in unrealistic planning schemes if they are not adequately addressed in transportation modelling and planning processes. Our quantitative review provides evidence to adjust travel demand models (McNally, 2007). Since people with disabilities have a significantly lower trip frequency (10–30%, particularly for non-work-related trips) than their non-disabled counterparts, a trip generation model (the first step of the four-step planning model) should be modified to predict the number of trips generated in an area. The findings of this study call for considering the variance observed in the whole population. The modifications of these models should be based on the land use of the corresponding area, which calls for more research about the impacts of the built environment.

It is even more challenging to represent the unique travel patterns of people with disabilities in the subsequent steps in traditional models, including trip distribution, mode choice, and traffic assignment. In the trip distribution stage (the second step of the four-step planning model), people with disabilities may make more intrazonal trips than interzonal ones, given our finding of their shorter travel distance and experience with more travel-time impedance. For the mode choice model (the third step of the four-step planning model), our findings shed light on variations in (dis-)utility of each mode. The perceived travel cost of driving will be higher for travellers with disabilities. In addition, people with disabilities may have limited options in transportation modes that are available to them due to various barriers discussed in the previous section. As a result, mode captivity (Krizek & El-Geneidy, 2007) needs to be explicitly considered in mode choice modelling for people with disabilities.

Lastly, the trip assignment model (the fourth step of the four-step planning model) also needs to be adjusted to reflect more travel-time impedance experienced by people with disabilities as well as a more restricted path set because of accessibility constraints. Moreover, people with disabilities may have different route choice criteria compared with the general population. For example, wheelchair travellers may consider factors other than distance, such as the width of sidewalk segments and slope, when making route choice decisions (Hashemi & Karimi, 2017). While we only provide specific implications for the traditional four-step modelling, the pooled statistics can be equally relevant to more advanced approaches such as the activity-based model (ABM) (Castiglione, Bradley, & Gliebe, 2015).

The barriers identified throughout our qualitative review can happen at any time in the trip chain, often causing a shift in travel behaviour or cancelled trips. The mobility of people with disabilities is inhibited in multiple distinct yet often connected ways. A transit system, vehicle, or station compliant with accessibility guidelines might still be unusable by people with disabilities. Professionals must address the systemic and social factors that have been found to affect mobility.

Safety, inclusion, and connectivity are factors that policy, practice, and guidelines should address for better mobility of people with disabilities. Safety was a repeated area of concern for individuals. Design standards that better meet the safety needs of pedestrians in these areas may be implementable in jurisdictions where these elements are barriers to access. Sidewalk lighting, improved crossing areas, information dissemination, and building façade design are often within areas of municipal control and can aid in creating safer feeling public spaces (Park, Farb, & Chen, 2021).

Feelings of inclusiveness were central to the use of public transit such as buses and trains. The feelings of exclusion come in the form of various barriers, some within the scope of policy or guideline control. Additional training for transit drivers on interaction with people with disabilities may help to increase trust and positive experiences between people with disabilities and service providers. Investment in paratransit and transit cross-training can create broader usability and flexibility for eligible riders (Bezyak et al., 2019; Meyers et al., 2002; Naami, 2019).

Connectivity of modes of transportation and consistent access from origin to destination are planning and design decisions that, when missed, can hinder usability for people with disabilities. A cohesive approach to connecting pedestrian and other spaces, as well as enforcement of compliance requirements in buildings, services, and programmes serving the public, is needed. These can help address first/last-mile issues, inaccessible destinations, and scheduling mismatches that limit mobility for people with disabilities.

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