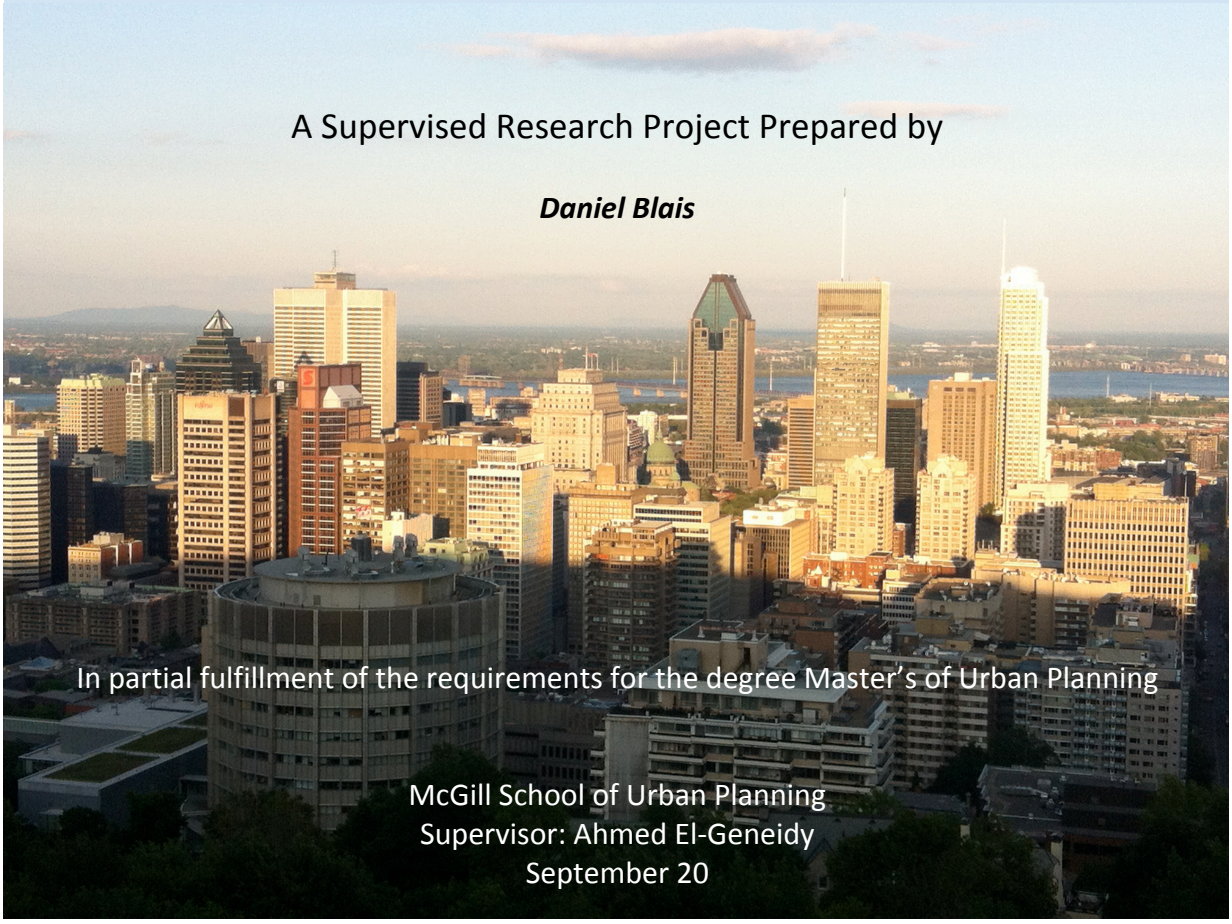
Better Living Through Mobility:
The relationship between access to transportation, well-being and type of disability



A Supervised Research Project Prepared by

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ABSTRACT

Much work on making transportation accessible for people with disabilities has focused on adapting environments and infrastructure. Less work has been done on understanding the relationship between access to transportation, well-being and type of disability. The objective of this report is to provide a better understanding of this relationship. This is achieved through a statistical and spatial analysis of Statistics Canada's 2006 Participation and Activity Limitation Survey (PALS). The statistical analysis consists of descriptive methods and a factor and cluster statistical analysis. The spatial analysis consists of mapping clusters of transit users and non-transit users in Toronto, Montreal and Vancouver. Results of the statistical analysis indicate that people with mental/cognitive disabilities are younger and have less income than people with sensory and physical disabilities. The statistical analysis also found that people with disabilities who have access to public transit have a higher sense of well-being. People who do not have access to public transit have a lower sense of well-being, and more so if they cannot afford personal transportation modes such as the car. This relationship between access to public transportation and well-being is more pronounced for people with mental/cognitive disabilities. The spatial analysis shows that people who are closer to major public transportation facilities will use transit more often and have a higher sense of well-being. The results of this research indicate that people with disabilities will have a greater quality of life if they live in areas that provide multiple transportation options. Built environments that facilitate walking and with enough density to support reliable and frequent transit options will ensure the greatest participation in society for people with disabilities. This is particularly true for people with mental/cognitive disabilities, who face an added barrier of having lower incomes and not being eligible for paratransit.

RESUME

La majorité des travaux portant sur l'accessibilité des transports pour les personnes handicapées ont visé l'aménagement des environnements accessibles et de l'infrastructure. En conséquence, peu de travaux ont misé sur la compréhension de la relation entre l'accessibilité au transport, le bien-être et le type de handicap. L'objectif de ce rapport est de fournir une meilleure compréhension de ce lien. Ce résultat est atteint par l'entremise d'analyses statistiques et spatiales de l'Enquête sur la participation et les limitations d'activités (EPLA) de 2006 de Statistique Canada. L'analyse statistique est composée de méthodes descriptives ainsi que d'une analyse factorielle et d'un partitionnement de données. L'analyse spatiale est composée de la transposition géographique du partitionnement de données des usagers du transport en commun et des non-usagers à Toronto, Montréal et Vancouver. Les résultats des analyses statistiques indiquent que les personnes avec un handicap mental sont plus jeunes et ont moins de revenus que les personnes avec un handicap sensoriel ou physique. L'analyse statistique indique aussi que les personnes handicapées qui ont accès au transport en commun ont un sens du bien-être plus grand. Les personnes n'ayant pas accès au transport en commun ont un sens du bien-être inférieur, surtout s'ils n'ont pas les moyens financiers pour utiliser un mode de transport personnel tel que l'auto. Le lien entre l'accès au transport en commun et le bien-être est plus marqué pour les personnes avec une incapacité mentale ou un déficit cognitif. L'analyse spatiale indique que les personnes qui habitent à proximité des services de transport en commun utilisent ces services plus fréquemment et ont un sentiment du bien-être plus élevé. Les résultats de ce projet de recherche montrent que les personnes avec un handicap jouiront d'une meilleure qualité de vie s'ils habitent dans des régions qui ont de multiples options de transports. Des aménagements facilitant l'accès piétonnier et des endroits où la densité de la population garantit des systèmes de transport en commun fréquent et fiable assurent une meilleure participation sociale des personnes handicapées. Ceci est particulièrement vrai pour les personnes avec un handicap mental qui ont moins de revenus et qui ne sont pas admissibles au transport adapté.

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1. INTRODUCTION

1.1 Background

A person's ability to move freely, without encountering barriers is an essential human right as transportation allows people to carry out activities essential for daily living. However, certain segments of the population encounter obstacles that restricts their mobility and accordingly their ability to carry out daily activities. These obstacles include poor design of the physical environment, lack of information, negative attitudes and cost of transportation. People who live with sensory, physical, mental and cognitive disabilities may encounter these obstacles and may be at a disadvantage when it comes to using the existing transportation system. This report focuses on trying to understand the relationship between access to transportation, well-being and type of disability. This will be achieved through a review of previous research and documents and through statistical and spatial analysis of responses to the Statistics Canada 2006 Participation and Activity Limitation Survey (PALS). PALS is a post-censal survey designed to collect information on people with disabilities whose everyday activities are limited because of a condition. The survey respondents represent approximately 5.2 million people 15 years old and over in Canada. Of those, approximately 4.2 million people indicated that they have a disability (Statistics Canada, 2011). The research review will include research and policy documents on disability, mental/cognitive disability and transportation. The statistical analysis will consist of summary statistics, principle component factor analysis and k-means cluster analysis. The spatial analysis consists of mapping clusters of transit users and non-transit users in Toronto, Montreal and Vancouver. The findings of the research review and statistical analysis are synthesized in order to provide a discussion on how transportation can most effectively improve the well-being and quality of life of people with disabilities. Much work on making transportation accessible has focused on accommodating sensory disabilities (sight and hearing) and physical disabilities (reduced mobility). This has been done through adaptations to existing environments and infrastructure. Despite these efforts, little work has been done in the area of understanding how access to transportation can affect the quality of life of people with mental/cognitive disabilities (Hunter-Zaworski, 1993; Risser, Iwarsson, & Ståhl, 2012).

Mental disabilities and cognitive disability are two distinct types of disabilities that share a number of characteristics. Both have to do with conditions affecting the brain and both differ from

sensory and physical disabilities in that they are often not visible to others. Mental and cognitive disabilities are also unique in a transportation context as difficulties are related to the ability to understand and process information while in a challenging environment. While they are distinct, these two types of disabilities are not mutually exclusive. A mental disability will predominately affect a person's emotions and behaviour. A cognitive disability will predominantly affect a person's concentration, memory and communication (International Transport Forum, 2009). From a societal perspective, there is a general lack of understanding of the difficulties that people with mental/cognitive disabilities live with. Stigma and insensitivity are still very prevalent (Health Canada, 2002). It is my hope that this report can contribute to a better understanding of mental/cognitive disability and raise awareness of the difficulties this segment of the population encounter in their daily lives, especially in a transportation context.

Beyond my own reasons for better understanding the transportation difficulties people with mental/cognitive encounter and raising awareness, there are demographic trends that motivate this research. Statistics Canada reports that in 2006, over 4.4 million Canadians (14% of the population) have a physical or mental disability, which limits their daily activities. The link between aging and disability has been well established. In Canada, more than 40% of persons aged 65 and over report having a disability; this increases to 53.3% for persons 75 and over. With the projected aging of the Canadian population (those 65 and over are expected to increase from 4.2 million in 2005 to 9.8 million in 2036), we can expect that there will be more people with disabilities who need accessible transportation to ensure their mobility for all (Turcotte & Schellenberg, 2006).

Transportation is required to carry out necessary daily activities. If certain segments of the population are denied access to transportation, their well-being and quality of life is diminished. There is ample work on this topic and it will be presented in this report. Equality rights for persons with physical or mental disabilities have been enshrined in Canadian law since the ascension of the Canadian Charter of Rights and Freedoms in 1982. The inclusion in the Charter of both mental and physical disabilities as prohibited grounds of discrimination represents an important evolution in Canadian legislation, for until the Charter, Canadians with mental disabilities received limited protection. Accessibility to transportation services for persons with disabilities is ensured through the Canada Transportation Act, which contains provisions relating to accessibility in transportation for people with disabilities, , but which are limited to federally regulated modes of public transport (Human Resources Development Canada, 2003).

1.2 Research objective:

The objective of this report is to provide insight into the relationship between access to transportation, well-being and type of disability. The results of this report will provide a better understanding of how future planning efforts can be focused to improve accessibility to transportation for this segment of the population, and in particular, people with mental/cognitive disabilities.

1.3 About this report:

This report is made up of four sections:

a) **Concepts, definitions, and trends:** Explanations of conceptual models, definitions of disability, descriptions of demographic trends, explanation of the relationship between wellbeing and transportation and an explanation of the human rights provisions for accessibility.

b) **Research review of transportation and people with mental/cognitive disabilities:** Description of travel limitations and solutions for people with mental/cognitive disabilities based on previous research.

c) **Statistical and spatial analysis:** Statistical and spatial analysis of the transportation needs of people with mental/cognitive disabilities based on the Statistics Canada's 2006 Participation and Activity Limitation Survey (PALS).

d) **Discussion and synthesis:** Discussion on the findings of the three previous sections and synthesis of recommendations to address the transportation needs of people with mental/cognitive disabilities.

2. CONCEPTS, DEFINITIONS AND TRENDS

The following sections provide explanations of conceptual models, definitions of disability, descriptions of demographic trends and an explanation of the relationship between well-being and mobility.

2.1 Conceptual models of disability and definitions

Disability can be perceived as an individual's condition (the medical model) or as a socially constructed obstacle (the social model). The medical model views disability exclusively as a

problem of the individual directly caused by disease, trauma, personal tragedy and/or other health conditions. According to this model disability calls for medical or other professional treatment to 'correct' the problem, abnormality or defect. By contrast, the social model conceptualizes disability as a socially created problem that imposes socio-economic, cultural and political disadvantages and not an attribute or characteristic of an individual. According to the social model, disability demands social action, since it is created by an unaccommodating environment (Human Resources Development Canada, 2003; Ustun, Chatterji, Bickenbach, Kostanjsek, & Schneider, 2003). There are critics of both of these models. Some say that the medical model ignores the role of the environment in the disabling process. Further, by locating the defect in the individual, that person may be defined as abnormal and biologically or mentally inferior (Human Resources Development Canada, 2003). This can create negative attitudes, which can also be an obstacle. Disability is not a characteristic that should stigmatize a person or detract from their value as a human being (M. McCluskey, 1988). Critics of the social model claim it ignores the complex reality of having a disability by making it exclusively a socially created problem (Ustun et al., 2003).

The World Health Organizations (WHO) subscribes to a model that synthesizes what is true and useful in the medical and social models, without reducing complex notions of disability to one aspect. This model is known as the biopsychosocial or functional limitation model. It synthesizes individual medical aspects with physical and social environment aspects (Ustun et al., 2003). Through this model, the WHO defines disability in terms of functioning and disability. Functioning refers to being able to complete major day-to-day activities and disability refers to the inability to perform these activities within the normal range of human ability as a result of impairment. Like the medical model, the functional limitation model measures a person's abilities and restrictions against a 'normal human standard' (Human Resources Development Canada, 2003). Such a normal human standard that represents those who are able-bodied is incorrect because it implies that disability is unusual, deviant and abnormal in a normative sense and strengthens prejudice and stigmas against people with disabilities. This type of prejudice is central to the problems that people with disabilities have had to face in society and have resulted in biased assumptions, which have led to the development of inadequate regulations. Equality legislation for people with disabilities is modeled after the same anti-discrimination legislation for race and sex. However, courts and lawmakers interpreting

disability legislation have often assumed that physical difference, not prejudice, is the primary problem. According to McClusky, this perception is flawed and results in legal decisions that are inadequate. She states that “most people are "disabled" compared to professional athletes or opera singers” to emphasize her point (McCluskey, 1988). In Canada, definitions of disability are based on the social model, considering disability from the human rights and social equity perspectives. Disabilities are complex and multi-dimensional and providing a single standard definition may not be desirable from this perspective (Human Resources Development Canada, 2003). The Charter of Rights and Freedoms defines disability as “any previous or existing mental or physical disability and includes disfigurement and previous or existing dependence on alcohol or a drug”. Discrimination on the grounds of disability is prohibited in order to ensure the full participation of people with disabilities in Canadian society (Department of Justice Canada, 1982). Within the context of transportation and mobility, the Canada Transportation Act of 1996 does not specifically define disability; rather it addresses obstacles to accessibility in order to ensure equal access to transportation services. Within a legal context in Canada, it is discriminatory and prohibited to treat people with mental/cognitive disabilities differently from those with physical or sensory disabilities The Charter emphasizes positive measures to correct disadvantages. This recognizes that equality does not mean treating all individuals the same way, but rather, recognizing and accommodating their differences (Human Resources Development Canada, 2003). In the US, a similar approach known as a disparate impact approach to discrimination is proposed. This approach prohibits explicitly unequal treatment, but also neutral treatment that has unnecessary unequal affects (McCluskey, 1988).

2.2 Definition of mental/cognitive disability

Mental/cognitive disabilities are defined as a pathological condition resulting from a disease, injury, or other trauma involving the cerebral hemispheres that disrupts attention, perception, memory, problem solving, calculations and reasoning and affects the ability to interpret and communicate concepts and instructions. These types of disabilities may result from neurological conditions, long-term emotional and psychological conditions and substance addiction. Mental/cognitive disabilities cover a wide variety of conditions ranging from communication, memory, learning, developmental or emotional disabilities as well as impairments resulting from brain injuries (e.g.: stroke, head injuries). The degree of severity of disability can range from

mild to severe and they are often unseen (Arthanat, Nochajski, & Stone, 2004; Hunter-Zaworski, 1993; Rutenberg, Arnold, & Wallersteiner, 1999; Scheid, 2005; Turnbull & McKenzie, 1998). While there is a distinction between mental and cognitive, the two are not mutually exclusive. A mental disability is characterized by alterations in thinking, emotions and behavior. A cognitive disability will predominantly affect a person's concentration, memory and communication (Health Canada, 2002; International Transport Forum, 2009). Mental/cognitive disabilities can have a significant influence on activities essential for daily living such as communication, mobility, self-care, domestic life, interpersonal interaction and relationships. Addressing these types of disabilities is essential to enhance independence and quality of life (Arthanat et al., 2004).

2.3 Demographic trends

Globally people with disabilities represent 15.6% percent of the population (ranging from 11.8% in higher income countries to 18.0% in lower income countries) and there is a trend towards an aging population at unprecedented rates in many higher income countries. There is a well-established link between older age and higher disability rates (World Health Organization and World Bank, 2011). For Canada, projections indicate that those 65 years old and over are expected to increase from 4.2 million in 2005 to 9.8 million 2036 (Turcotte & Schellenberg, 2006). More than 40% of Canadians aged 65 and over report having a disability; this increases to 53.3% for persons 75 years old and over (Statistics Canada, 2007). While it is established that aging brings about a decline in physical and cognitive functions, the general health of the population and life expectancies have improved significantly during the last century. As a result biological decline due to old age will occur later in life. We can expect more older adults and therefore more people with disabilities and reduced mobility in the future (Waara & Ståhl, 2004). The relationship between disability and aging is also prevalent for mental/cognitive disabilities. The WHO reports that 10% of persons over 65 years old and 50% of those over 85 years old have some form of cognitive disability (Arthanat et al., 2004). The impacts of these demographics trends on the transportation sector will be significant. As people age, their driving abilities diminish and in much of North America, mobility is reliant upon automobile use. There is great potential for transit to increase mobility for those who do not have access to a car, especially if living in an urban area (Davies, Stock, Holloway, & Wehmeyer, 2010). However, transit service may be

unfeasible in areas with low population density, and mainly limited to commuting hours. Retired seniors, (or people who do not work regular hours) require transit outside of commuting hours and limited transit service can impact their well-being. Kim and Ulfarsson (S. Kim & Ulfarsson, 2013) found that paratransit services are critical to the well-being of older people who have disabilities. Planners should be aware however, that using paratransit creates a segregated service that requires eligibility criteria for travelers and can reduce the incentive to make mainstream transit services flexible and accessible (Fischer & Sullivan, 2002).

2.4 Well-being and mobility

Research has clearly established that there is a link between people's well-being and their mobility (S. Kim & Ulfarsson, 2013; T. Kim, Choo, Shin, & You, 2013). The term well-being is synonymous with "quality of life". Measures of well-being are subjective and present how an individual's life is going from their own point of view (Duarte et al., 2009). Lack of mobility is detrimental to quality of life, as it may become a barrier to satisfaction of basic needs and participation in social life (Davies et al., 2010; Sammer et al., 2012; Wasfi, Levinson, & El-Geneidy, 2006). Having access to transportation, particularly public transportation, is crucial for ensuring access to employment and education (McCluskey, 1988). For the people with mental/cognitive disabilities the use of public transportation is linked to living independently, holding a job and socializing (Fischer, 2002; Rosenkvist, 2007; Davies, 2010). For people with mental/cognitive disabilities access to work can be beneficial for mental health by providing the opportunity to develop skills, self-esteem and well-being. Employment plays a vital role in the recovery and rehabilitation of people with mental disabilities, by providing income, daily structure, social contact, purpose and self-esteem. For people with mental/cognitive disabilities, lack of transportation, stigma and discrimination are cited as reasons for unemployment (An, Roessler, & McMahon, 2011).

3. RESEARCH REVIEW OF TRANSPORTATION AND PEOPLE WITH MENTAL/COGNITIVE DISABILITIES

A systematic review was undertaken of the available literature on transportation accessibility for people with mental/cognitive disabilities. Key word searches were done in a number of databases. The key words included transportation, mental, cognitive, disability, impairment, accessibility and

derivatives (e.g.: access, accessible, disabled, impaired, etc.). The databases queried for academic publications included Scopus, Transport, TRID and Web of Knowledge. The databases queried for conference papers included Transportation Research Board Annual Meeting papers from 2008, 2009, 2010, 2011, 2012, 2013 and the International Conference on Transportation for Elderly and Disabled Persons papers from 2004 (Japan), 2007 (Montreal), 2010 (Hong Kong). This review found that early studies often investigated mental/cognitive disabilities along with sensory disabilities, yet treated them separately. Suen et al. (Suen, McInerney, & Barkow, 1992) recognized that "cognitive/emotional disabilities" present a more varied set of difficulties than sensory disabilities.

3.1 Travel limitations for people with mental/cognitive disabilities

While it is often stated that there is little research on transportation for people with mental/cognitive disabilities, this report shows that a considerable effort that has gone into studying the topic. Travel limitations for people with mental/cognitive disabilities differ from travel limitations for people with sensory and physical disabilities. Mental/cognitive disabilities present a more varied set of difficulties than sensory disabilities. The limitations are much less obvious and the disability itself is often not visible to others (Rosenkvist, Wendel, Stahl, Risser, & Iwarsson, 2007). Suen et al. (Suen, McInerney, & Barkow, 1992) point out that having a mental/cognitive disability does not imply travel difficulties. Certain mental/cognitive disabilities are unrelated to travel difficulties (e.g.: addiction) and others can be treated and therefore do not pose a travel difficulty (e.g.: treating schizophrenia with medication). The study by Wasfi et al. focuses its research on what it refers to as people with a developmental disability who are 'transportation disadvantaged'. These are people who cannot meet their mobility needs independently, as opposed to transportation advantaged, who can. People with a disability may be transportation advantaged or disadvantaged, depending on the severity of their disability (Wasfi, Levinson, & El-Geneidy, 2006). Previous research has identified a number of complex difficulties people with mental/cognitive disabilities live with that can cause travel limitations. These difficulties are associated with tasks including reading, concentrating, retrieving and interpreting information, understanding abstract concepts, problem solving, managing time pressures and schedules, using memory, ignoring irrelevant stimuli, multi-tasking, orientating, and making decisions. These tasks are required in transportation contexts and they can cause

anxiety, confusion and fright, which can affect temper and speech (Hunter-Zaworski, 1993; Lamont, 2010; Rutenberg et al., 1999; Suen, McInerney, & Barkow, 1992; Turnbull & McKenzie, 1998). Travel difficulties can occur both in vehicles and in terminals and can include understanding announcements, dealing with unexpected route changes, asking for assistance, interpreting displays, signage, schedules and maps and locating public amenities (Fischer & Sullivan, 2002; Rosenkvist, Wendel, Stahl, Risser, & Iwarsson, 2007; Suen & Chan, 2013). The combination of these difficulties can negatively feedback on each other, possibly resulting in the traveler unable to complete a trip or unable to pursue an activity from which the trip is derived (Suen, McInerney, & Barkow, 1992). This can limit opportunities and create social exclusion (Lamont, 2010).

4. STATISTICAL AND SPATIAL ANALYSIS

A statistical and spatial analysis of PALS contributes to better understanding the relationship between access to transportation, well-being and type of disability. The statistical analysis consists of descriptive methods to provide summary statistics and a factor and cluster analyses. Summary statistics are used to provide information on disability and age, disability and income, and disability and modes of transportation used for local (less than 80 km) and long distance (more than 80 km) trips. Factor analysis was used to obtain an understanding of the factors that affect the mobility of respondents. The factor loading is then used as an input in a K-means cluster analysis to group respondents into homogeneous subgroups based on responses to survey questions (Krizek & El-Geneidy, 2007). A spatial analysis was undertaken by mapping the results of the K-means cluster analysis to assess whether population density and proximity to transportation features is linked to transit use and well-being.

4.1 About the data

PALS is a national post-censal survey designed to collect information on people who have a disability or whose everyday activities are limited because of a health problem. PALS provides information on supports for people with disabilities, their employment profile, their income and their participation in society (Statistics Canada, 2007). The analysis for this study was conducted on respondents who are 15 years or older. PALS collects information on ten types of disabilities that are listed and described below:

- Hearing: Difficulty hearing what is being said in a conversation.
- Seeing: Difficulty seeing ordinary newsprint or clearly seeing someone's face from 4 meters away.
- Communication: Difficulty speaking and/or being understood.
- Mobility: Difficulty walking, negotiating stairs, carrying an object of 5 kg for 10 metres or standing for long periods.
- Agility: Difficulty with tasks such as bending, dressing, getting into or out of bed, grasping or handling objects, reaching, etc.
- Pain: Activity limitation because of long-term pain.
- Memory: Activity limitation due to frequent periods of confusion or difficulty remembering things.
- Learning: Difficulty learning because of a condition.
- Developmental: Cognitive limitations due to an intellectual disability or developmental disorder.
- Emotional: Activity limitations due to an emotional or psychological condition.

Respondents to PALS could select more than one disability. In fact, the prevalence of multiple disabilities is quite common. In order to ensure an accurate interpretation of transportation difficulties, the information presented in this paper only includes respondents who selected one type of disability. Since there is a high prevalence of multiple disabilities a study on the relationship between disabilities should be considered for future research, but is outside the scope of the current effort.

For the summary statistics, the ten types of disability were re-organized according to Table 1 in order to simplify presentation of information and to meet the confidentiality requirements of using the PALS dataset. The ten disability types were not reorganized for the factor cluster analysis, in order to ensure better statistical significance.

TABLE 1 Disability typology

PALS 2006 Disability Types	Disability Types Used for Summary Statistics
Hearing Seeing	Sensory
Mobility Agility Pain	Physical
Emotional Communication Memory Learning Developmental	Mental/Cognitive

4.2 Summary statistics

Figure 1 shows the age of PALS respondents by type of disability. The figure shows that younger cohorts report having a mental or cognitive disability more frequently and that there is a higher incidence of physical and sensory disability as people age. The amount of respondents drops off at age 85 and older because there are less people in this cohort, but mental/cognitive disabilities increase. Suen (Suen & Chan, 2013) states that there is a higher rate of diagnosis among the young for mental/cognitive disabilities because older adults manage their disability with coping skills, and may not report it as frequently.

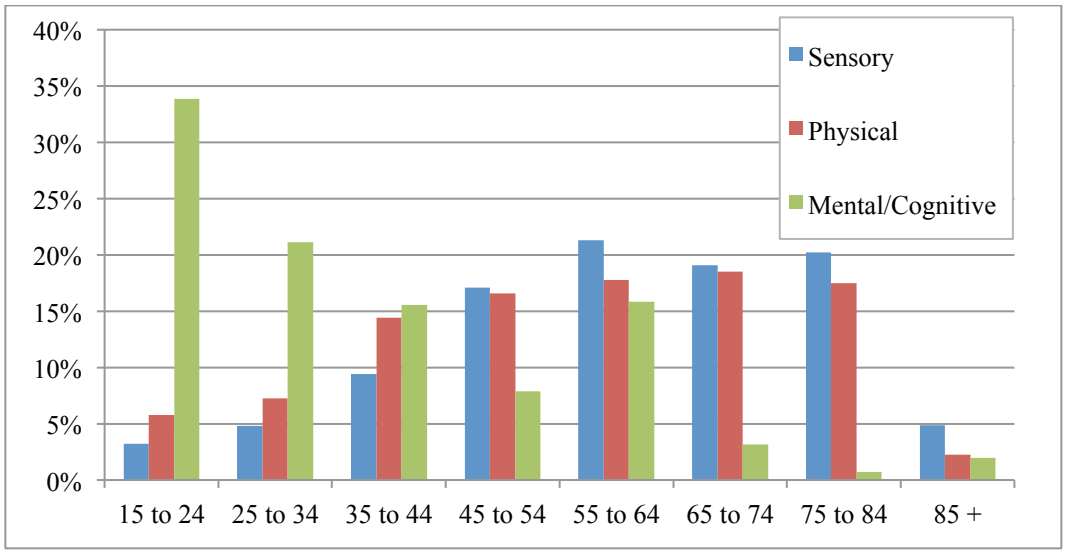


FIGURE 1: Age group by type of disability

Figure 2 shows total income by disability type. It shows that people with sensory and physical disabilities are more likely to be in a higher income group compared to people who have a mental/cognitive disability.

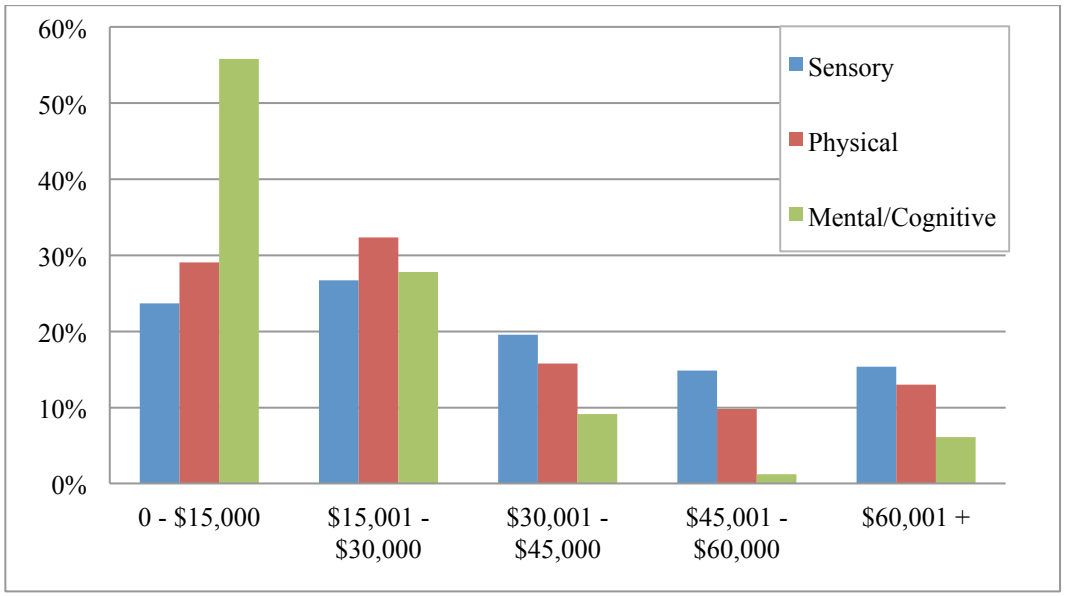


FIGURE 2: Types of disability and total income

Figure 3 shows the mode split by income. It shows that for lower income groups there are less car users with disabilities and more public transportation users with disabilities. Car users include mostly drivers and a small proportion of passengers. Public transportation includes bus, paratransit, subway and taxi.

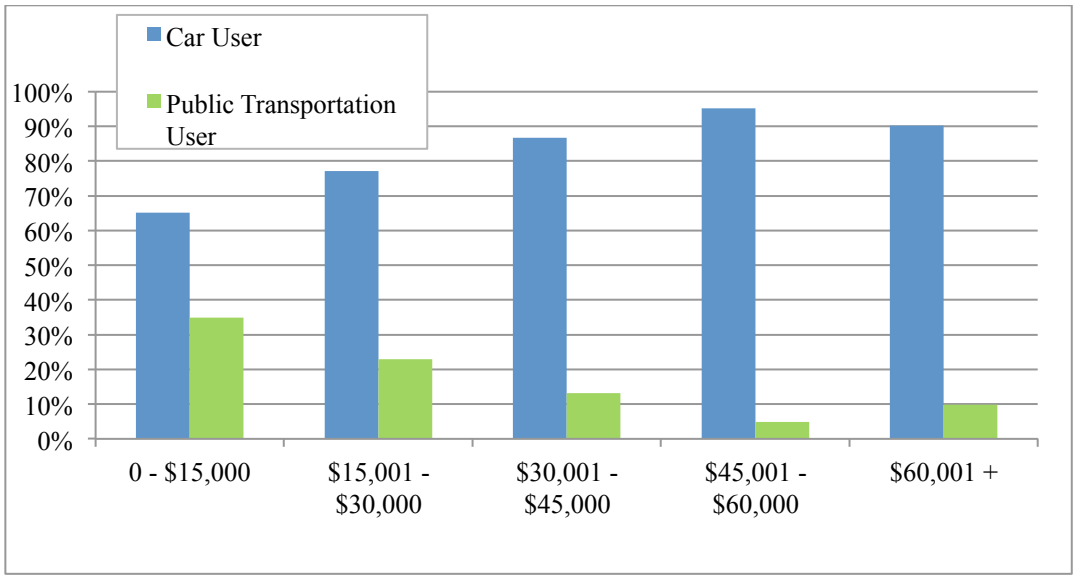


FIGURE 3: Mode of transportation and income

Figure 4 shows the mode split between car and public transportation by type of disability for local trips. The car is the preferred mode of transportation for all types of disability; however, people with mental/cognitive disabilities use public transportation more than people with sensory and physical disability. This may be related to the affordability of public transportation for local trips and the fact that people with mental/cognitive disabilities have lower incomes.

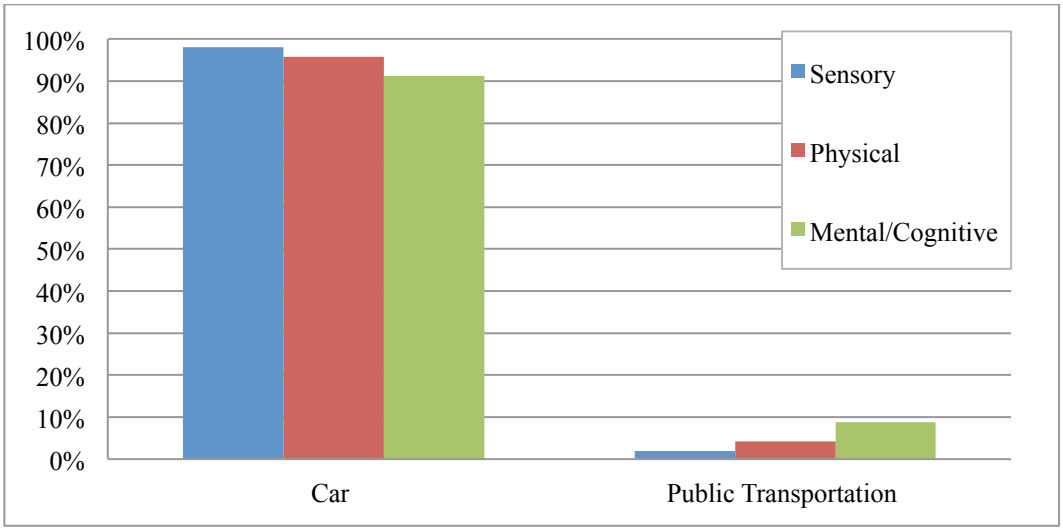


FIGURE 4: Local transportation by mode and type of disability

Table 2 shows the number of observations by type of disability in relation to long distance travel. Figure 5 shows the mode split between car, bus and train, airplane and other modes by disability for long distance trips. Car is the preferred mode, followed by air. There are a higher percentage of people with mental/cognitive disabilities who use the car, which could be related to the affordability of this mode for long distance trips. This group uses the air mode less for long distance trips, which is typically a more expensive mode.

TABLE 2: Number of people with disabilities who took long distance trips within the last 12 months since the PALS survey was administered

Disability	**Frequency**	**%**
Sensory Disability	83,210	41%
Physical Disability	152,910	40%
Mental/Cognitive Disability	26,770	43%

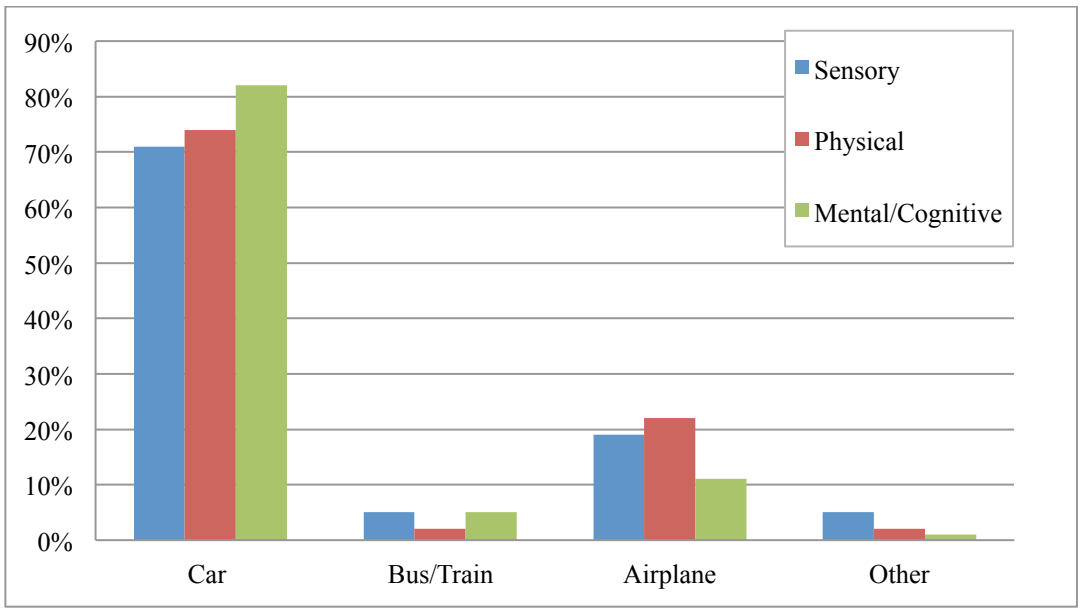


FIGURE 5: Long distance transportation by mode and disability type

4.3 Factor analysis

Factor analysis is used to learn how responses to survey questions (i.e.: variables) relate to one another. By doing so, it is possible to better understand how variables in one module (e.g.: satisfaction with life) relate to outcomes in another module (e.g.: local transportation) (Krizek & El-Geneidy, 2007). Responses to 34 variables, from the local transportation, satisfaction with life, social contacts and stress modules, as well as some socio-demographic modules including age, level of education, total income and employment, are analyzed. The analysis revealed 14 factors with Eigen values greater than 1, which are all retained as part of the analysis. The results of the factor loadings are displayed in Table 3. Within each of the 14 groups of variables, the high values (above about 0.5 in absolute value) are indicated in bold and green highlight. These 14 factors explained 65.4% of the overall variance in the data. Appropriate labels were assigned to describe each of the factors. It should be noted that certain factors only contained one variable, and as such these variables became standalone factors. The 14 factors are listed below:

1. **Pressures** are derived from variables measuring stress, age, employment and if parents are still living.
2. **Earning potential** include variables about having a learning disability, level of education and total income. This factor shows that if a person does not have a learning disability, they would have a higher level of education and higher income.

3. **Well-being** includes variables that measures satisfaction with life.
4. **Social interaction** includes variables about leaving the home to visit family, attend events and visit places.
5. **Transit use** includes variables that indicate that the respondent uses public transportation and does not use a car [1].
6. **Paratransit use** includes variables that indicate that the respondent used paratransit and had difficulty using paratransit.
7. **Travel barriers** includes variables about difficulties encountered while traveling by car, subway and taxi.
8. **Hearing disability** includes variables about having a hearing disability and a pain disability. There is a negative relationship between hearing disability and pain.
9. Does the respondent have a **Mobility disability**.
10. Is the respondent **Agile** (i.e.: the respondent does not have an agility disability).
11. **Mental disability** included variables asking if the respondent had a mental disability, had difficulty using the bus and if they felt they had been treated unfairly because of their condition. The high level of stigma towards mental disability explains why the question about being treated unfairly is grouped in this factor (Health Canada, 2002). Further, previous research has shown that people with mental disability encounter difficulties with insensitive public transit staff (Suen & Chan, 2013).
12. Does the respondent have a **Communication disability**.
13. Does the respondent have a **Memory disability**.
14. Does the respondent have a **Developmental disability**.

[1] It should be noted that the variable *Do you use a car* scored a coefficient of -0.469 and related to the Transit use factor variables. The *Do you use a car* variable was not included in the final factor analysis, but it could be assumed that those who use public transit are not using a car and those who do not use public transit are using a car.

TABLE 3: Results of factor analysis

Factor Groups	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pressures	Are you employed	**.689**	.241	-.024	.007	-.060	-.013	.042	.001	-.109	.052	-.127	-.091	-.070	-.045
	Is your mother still living	**.794**	-.043	-.068	.174	.051	.038	.016	-.024	-.010	.033	.072	.049	-.003	.023
	Is your father still living	**.732**	-.074	-.015	.122	.096	-.003	.080	-.077	-.034	.019	.144	.126	-.002	.034
	AGE	**-.829**	.176	.107	-.123	-.133	.037	-.052	.120	.050	-.063	-.094	-.071	-.022	-.036
	Amount of stress - most days (1 to 5)	**.540**	.327	-.253	-.090	.026	-.058	-.009	-.060	.028	.014	.142	-.087	.079	-.015
Earning potential	Do you have a learning disability	.342	**-.522**	-.054	.183	.009	-.065	-.022	.363	.097	-.025	-.143	-.109	.007	-.112
	Highest certificate, diploma or degree	.102	**.645**	-.042	.254	.202	-.022	-.017	-.086	-.041	.049	-.029	.010	.026	-.021
	Total Income - amount	.025	**.718**	-.071	.138	-.063	-.030	.056	.143	.020	-.014	-.090	-.069	-.038	-.050
Well-being	Feelings about relationships - family (1 to 10)	-.033	.210	**.659**	-.089	.018	.021	-.062	-.096	.098	-.217	-.025	.032	-.033	.060
	Feelings about relationships - friends (1 to 10)	.032	.076	**.692**	-.046	-.029	.038	.027	-.057	.176	-.095	-.045	.055	.082	.027
	Feelings about your health (1 to 10)	-.038	-.178	**.602**	.053	.046	.078	-.016	.281	-.134	.141	-.170	.010	-.039	-.033
	Feelings about job or main activity (1 to 10)	-.163	-.116	**.666**	.070	-.139	-.011	.005	.006	-.108	.115	.051	-.118	-.043	-.042
	Feelings about way spend time (1 to 10)	-.154	-.160	**.730**	.070	-.075	-.107	-.075	.047	-.028	.108	-.069	.004	.008	-.031
Social interaction	Do you visit family outside your home	.063	.139	.062	**.506**	-.073	.046	-.003	-.020	.199	.093	.071	.007	-.402	-.024
	Do you attend events outside your home	.199	.128	.022	**.731**	.105	.005	.037	-.109	.001	-.015	.057	-.084	.018	.012
	Do you visit places outside your home	.105	.068	.002	**.684**	.179	.033	.063	.025	-.237	.002	-.001	.006	.039	.021
Transit use	Do you use the bus	.070	-.132	-.037	.039	**.809**	.100	-.017	-.020	-.037	-.034	.116	.039	.028	-.013
	Do you use the subway	.074	.124	-.095	.008	**.756**	-.064	.054	-.002	-.070	.095	-.061	-.054	-.120	-.036
	Do you use the taxi	.050	.124	-.039	.264	**.627**	.027	.025	.005	.174	-.047	.097	.048	.079	.055
Paratransit user	Do you use paratransit	-.123	-.050	-.010	.130	.145	**.632**	-.031	.009	.186	-.015	-.087	.069	.084	-.005
	Did you have difficulty using paratransit	.073	.015	.008	-.058	-.074	**.812**	-.005	.005	-.108	.001	.063	-.053	-.056	.001
Travel barriers	Did you have difficulty traveling by car	.104	.040	-.013	.057	-.075	-.009	**.659**	-.148	-.002	-.054	-.055	.004	.160	-.003
	Did you have difficulty traveling by subway	.061	-.003	.047	-.121	.191	.034	**.677**	.018	-.063	.047	.229	-.140	-.166	-.032
	Did you have difficulty traveling by taxi	-.009	.016	-.098	.112	-.013	-.060	**.673**	.058	.068	.004	-.056	.119	.020	.031
Hearing disability	Do you have a hearing disability	-.202	.238	.073	-.078	-.054	-.012	-.062	**.566**	-.503	.363	-.065	.020	-.021	.033
	Do you have a pain disability	.200	.052	-.041	.116	.009	-.024	.062	**-.882**	-.160	.179	-.150	-.042	-.034	-.033
Mobility disability	Do you have a mobility disability	-.204	-.010	.064	-.139	.019	.048	.009	.119	**.834**	.169	-.025	-.035	-.039	.003
Agile	Do you have an agility disability	-.164	-.030	-.016	-.029	-.028	.011	.007	.085	-.122	**-.928**	-.027	-.021	-.032	-.011
Mental disability	Do you have an emotional disability	.139	.032	-.082	.024	.029	-.086	-.113	.042	.070	-.027	**.756**	-.068	-.003	.014
	Have you had difficulty traveling by bus	.022	-.089	-.007	-.030	.154	.214	.397	-.044	-.113	.073	**.666**	-.120	-.098	-.024
	Have you been treated unfaily due to your condition	.083	-.071	-.149	.142	.024	-.044	.010	.089	-.034	.016	**.604**	.368	.129	-.022
Cognitive com	Do you have a communication disability	.069	-.022	.018	-.084	.017	.012	.019	.013	-.025	.017	.004	**.901**	-.058	-.018
Cognitive mem	Do you have a memory disability	.008	.018	.019	-.006	-.037	.026	.047	.014	.009	.047	.036	-.040	**.880**	-.016
Cognitive dev	Do you have a developmental disability	.029	-.033	-.009	.020	-.006	-.004	.006	.021	-.003	.010	-.013	-.021	-.011	**.983**

4.4 Cluster analysis

All factors loadings are saved to be used in a cluster analysis. A cluster analysis is used to identify groupings of respondents with similar characteristics based on the factor loadings from the 14 different factors identified in the previous step. The clustering process uses the K-means statistical routine and these groupings are based on transit use and disability type. The routine allows the researcher to specify the number of clusters that are created, and an output of 4 clusters was selected. The decision to use 4 clusters was based on the statistical output, the manner in which the output is interpreted, and precedents from previous research. Cluster membership and values associated to factor loading are displayed in Figure 6. Examining the defining characteristics and preferences of each cluster reveals four distinct groups. These groups split as those who use transit and those who do not use transit. Transit users and non-transit users breakdown into two subgroups, those who reported having a mental disability and those who reported have a sensory or physical disability.

The breakdown of clusters is the following: transit users represent 46.7% of which 3.7% have a mental disability and 43% have a sensory or physical disability; non-transit users represent 53.3% of which 27% have a mental disability and 26.3% have a sensory or physical disability. The height and direction of each bar in Figure 6 graphically presents the value of the cluster center for each of the 14 factors. Color-coding was used to identify categories of factors. Orange shades represent social and demographic factors, blue shades represent transportation factors and green shades represent disability factors.

Upon closer inspection, several defining characteristics stand out. Both types of transit users tend to have slightly lower pressures than the non-transit users and much lower earning potential. However, both types of transit users have higher levels of well-being than non-transit users. Transit users with mental disabilities score much lower on the social interaction factor compared to transit users with sensory or physical disabilities. Transit users with mental disabilities use transit less and paratransit much less than transit users with sensory or physical disabilities. This could be due to eligibility criteria for using paratransit. Transit users with mental disabilities encounter more travel barriers than transit users with sensory or physical disabilities. For non-transit users, those with mental disabilities have a very low level of well-being and social interaction and experience much higher travel barriers. The non-transit users with sensory or physical disabilities have a much higher earning potential, well-being and social interaction and lower travel barriers. This could be related

to the fact that they can afford personal transportation and are therefore more mobile. Overall the non-transit user with sensory or physical disabilities cluster fares the best inter terms of social and demographic factors.

In summary the results of this analysis show that transit users with disabilities have lower income and lower level of education overall, yet this does not necessarily affect their sense of well-being. It shows that non-transit users have higher levels of income and education, yet lower levels of well-being than transit users. The results of the data analysis indicate that people with low socio-economic status, a limited social network and limited transportation options will have a lower quality of life. The results will be discussed further in the Discussion section.

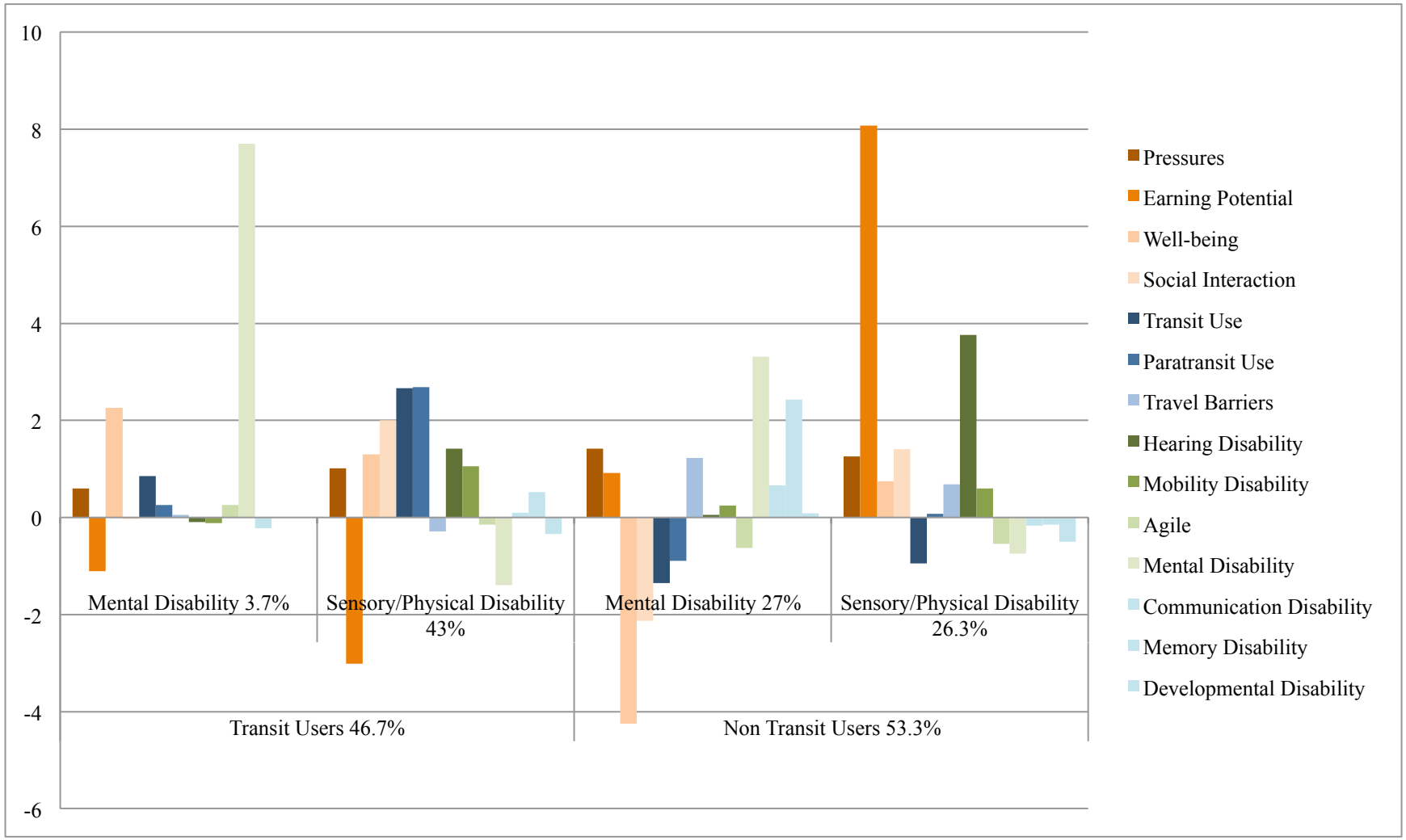


FIGURE 6: Graphic display of cluster analysis

4.5 Spatial analysis

For the spatial analysis, the two cluster groups (transit user and non transit user) in Toronto, Montreal, and Vancouver are mapped. The two cluster groups and three cities were chosen in order to meet the confidentiality requirements of the dataset. Both cluster groups are made up of people who have a disability and may be transportation disadvantaged. The density of each city is used as a measure to show that people in cities with higher population density will have a higher level of well-being. The three cities provide comparable options for public transportation services. The location of comparable transportation facilities in each city (Metro, Subway and Skytrain) was added to the analysis to see if this has an impact on well-being. It is expected that the clusters located closer to the transportation facilities will have a higher well-being score. The population, population density and transportation services of each city are listed in the Table 4. This information is for the city itself and not the census metropolitan area.

TABLE 4: Population, density and transit services for Toronto, Montreal and Vancouver

City	Population	Population Density	Available Transit Services
Toronto	2,615,060	4,149/km^2	Bus, Subway, LRT, Commuter Rail
Montreal	1,649,519	4,158/km^2	Bus, Subway, Commuter Rail
Vancouver	603,502	5,249/km^2	Bus, LRT, Ferry

Chi square analysis is used to confirm the significance of the positive relationship between population density, transportation service availability and well-being. Chi square is an effective way to show that these elements are linked. Transit use is being used as a proxy for well-being as the transit user clusters were found to have a higher well-being than non-transit users. A chi square value greater than .5 will show that the relationship is significant. Figure 7 shows the breakdown of the transit user and non-transit user by city. While the proportion of transit users is quite high for all three cities, the significance of the relationship between density and well-being is poor, with a chi square value of .32. Clearly the city with the highest population density, Vancouver, has more transit users, but Toronto, the city with the lowest density has the second most transit users. This leaves Montreal as an anomaly in trying to establish the relationship between density and well-being. The higher transit use, and higher level of well-being by people with disabilities in Toronto may be explained by how the transportation service is provided. A larger sample base of cities may confirm this relationship, leaving Montreal as an outlier.

However, the confidentiality limitations of the current dataset does not allow for further analysis. Investigating the reasons for why Montreal has less transit users and a lower level of well-being for people with disabilities should be considered. This may reveal a number of factors about how transportation services are provided and the relationship between transit use and well-being.

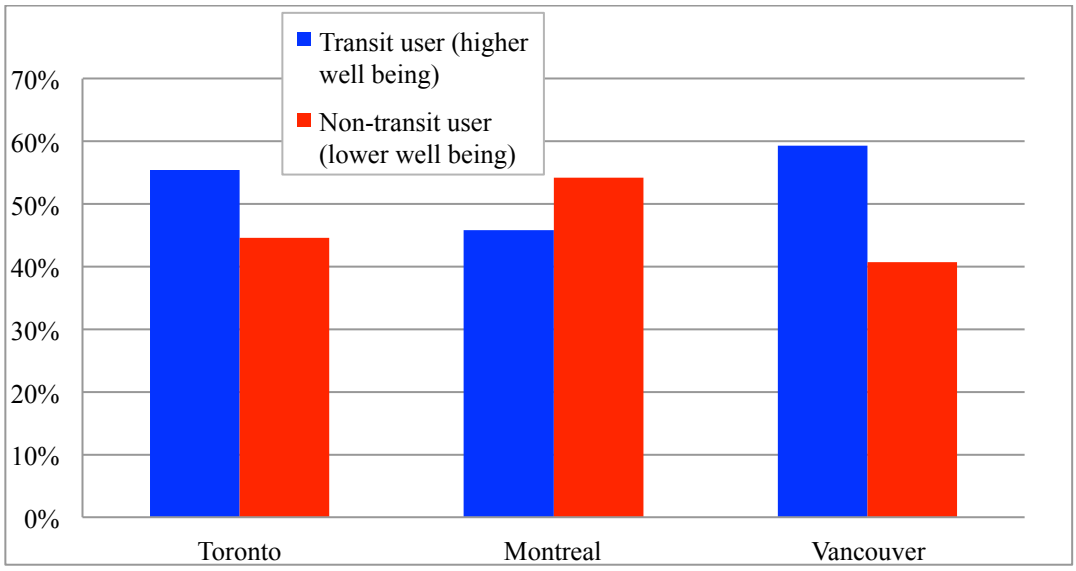


FIGURE 7: Transit user cluster groups vs non-transit user cluster groups by city

When looking at the relationship between the proximity of transportation services and wellbeing, Figure 8 shows that people with disabilities with higher well-being are located closer to transportation services. Within a buffer of 1000m around transit stops, there are 54% of transit users with higher well-being and 46% of non-transit users with lower well-being. The results of the chi square analysis are of .571 indicate a significant positive relationship between the transit use/well-being of people with disabilities and proximity to transportation services. Proximity maps for Toronto, Montreal and Vancouver are shown at Figures 9, 10 and 11.

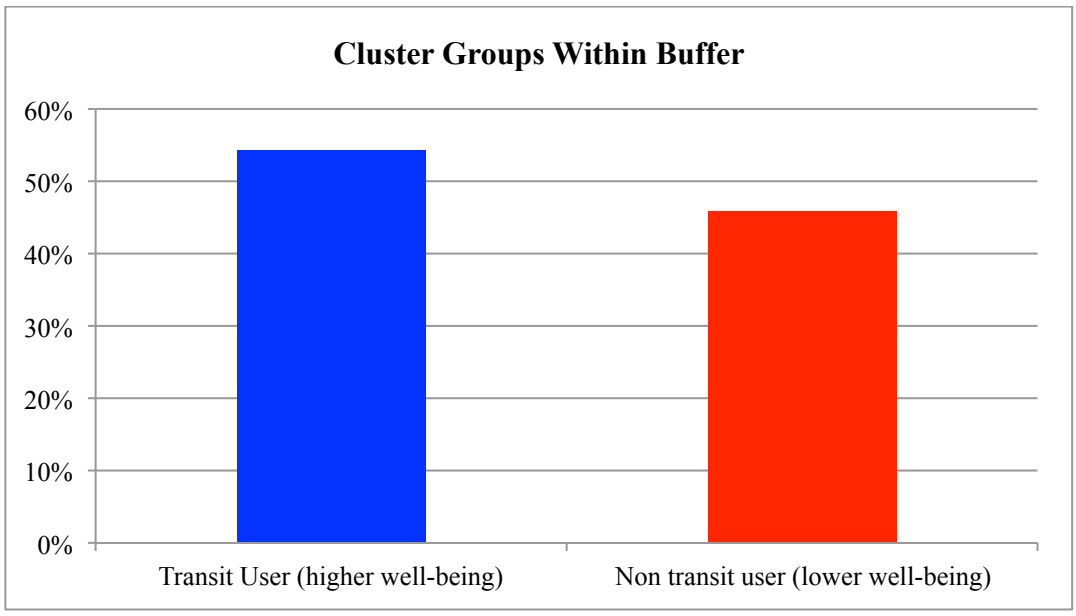


FIGURE 8: Transit user and non–transit user cluster groups located within 1000m of a transit stop

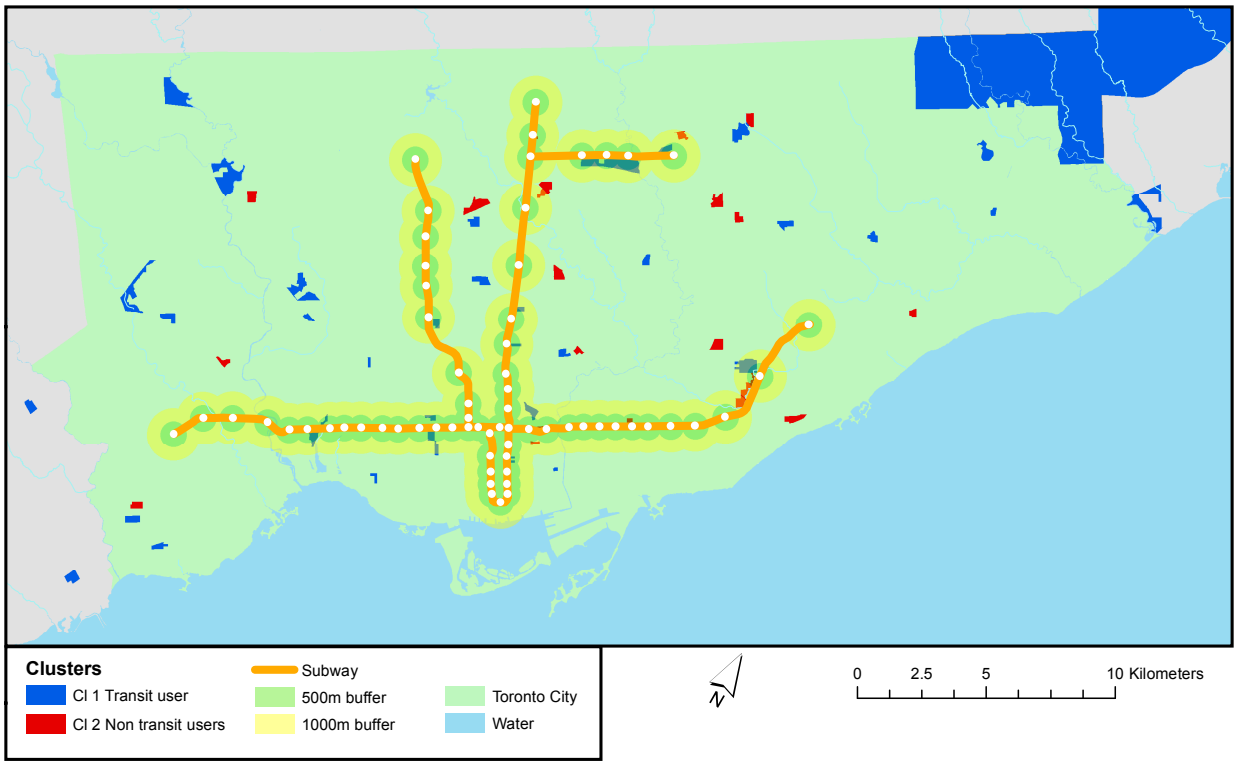


FIGURE 9: Toronto distribution of clusters and subway proximity buffer

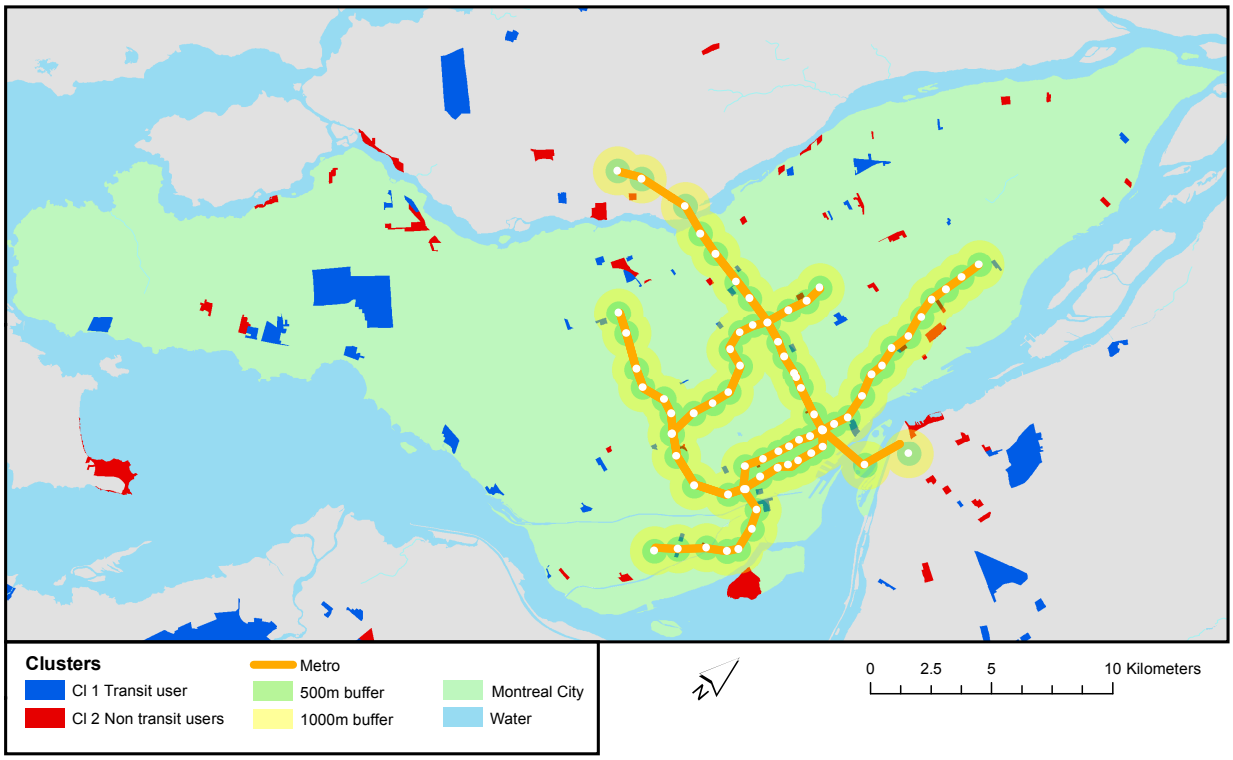


FIGURE 10: Montreal distribution of clusters and metro proximity buffer

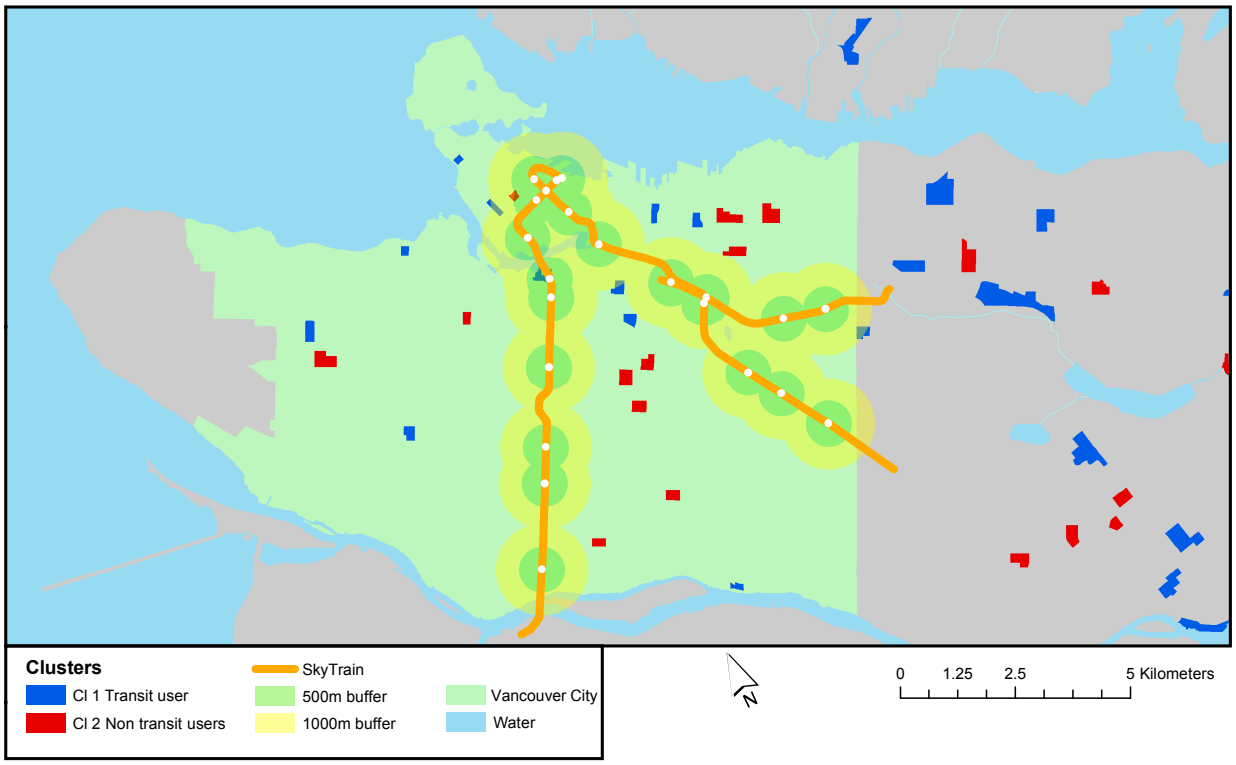


FIGURE 11: Vancouver distribution of clusters and SkyTrain proximity buffer

5. DISCUSSION

The results of the factor/cluster analysis are consistent with existing research. The analysis indicates that transit users have slightly lower pressures and much lower earning potential. Previous research has shown that transit users are often seniors, or have disabilities and have lower incomes (Krizek & El-Geneidy, 2007). However, transit users tend to have a higher sense of well-being than non-transit users. Transit availability is much higher in denser urban environments. While incomes for transit users may be lower than non-transit users, there are more potential opportunities for interaction in denser urban areas, which could explain the higher well-being. For non-transit users with mental/cognitive disabilities, not having access to transit could significantly affect well-being and hinder social interaction, particularly for individuals without access to a car living in sub-urban environments. Having a higher income and being able to afford personal transportation, or being eligible for paratransit will improve well-being and social interaction. A quantitative study undertaken by Kim and Ulfarsson (S. Kim & Ulfarsson, 2013) confirms these findings. Their results show that lack of transportation in general is found to be a significant factor negatively associated with quality of life and that a built environment, which facilitates walking, is found to be positively associated. Duarte et al. (Duarte et al., 2009) also find a significant relationship between mode choice and well-being. Like this study, they found happier people more prone to using public transportation. Having access to public transportation, is crucial for ensuring access to employment and education (McCluskey, 1988). For the people with mental/cognitive disabilities the use of public transportation is linked to living independently, holding a job, socializing and well-being (Davies et al., 2010; Fischer & Sullivan, 2002; Statistics Canada, 2007).

Figure 12 illustrates the different characteristics of the four clusters in relation to levels of well-being, income, social interaction, social exclusion and access to transit. The figure highlights the relationship that access to transit has on well-being. Having access to transit has a more significant influence on well-being than having a higher income. People with higher incomes who do not have access to transit may be able to afford personal transportation as indicated by the non-transit user with sensory or physical disabilities cluster. However, their level of well-being is not as high as transit users with sensory or physical disabilities. Further, non-transit users require a much higher income to have a slightly higher well-being. Both transit users and non-transit users with sensory or physical disabilities have positive levels of social

interaction, but it is higher for transit users. For people with mental disabilities the impacts of having access to transit are drastic. Transit users with mental disabilities have the highest level of well-being. Non-transit users with mental disabilities have the lowest levels of well-being and social interaction. They are also found to have the highest travel barriers. Providing non-transit users with mental disabilities access to transit will greatly enhance their quality of life, social interaction and independence.

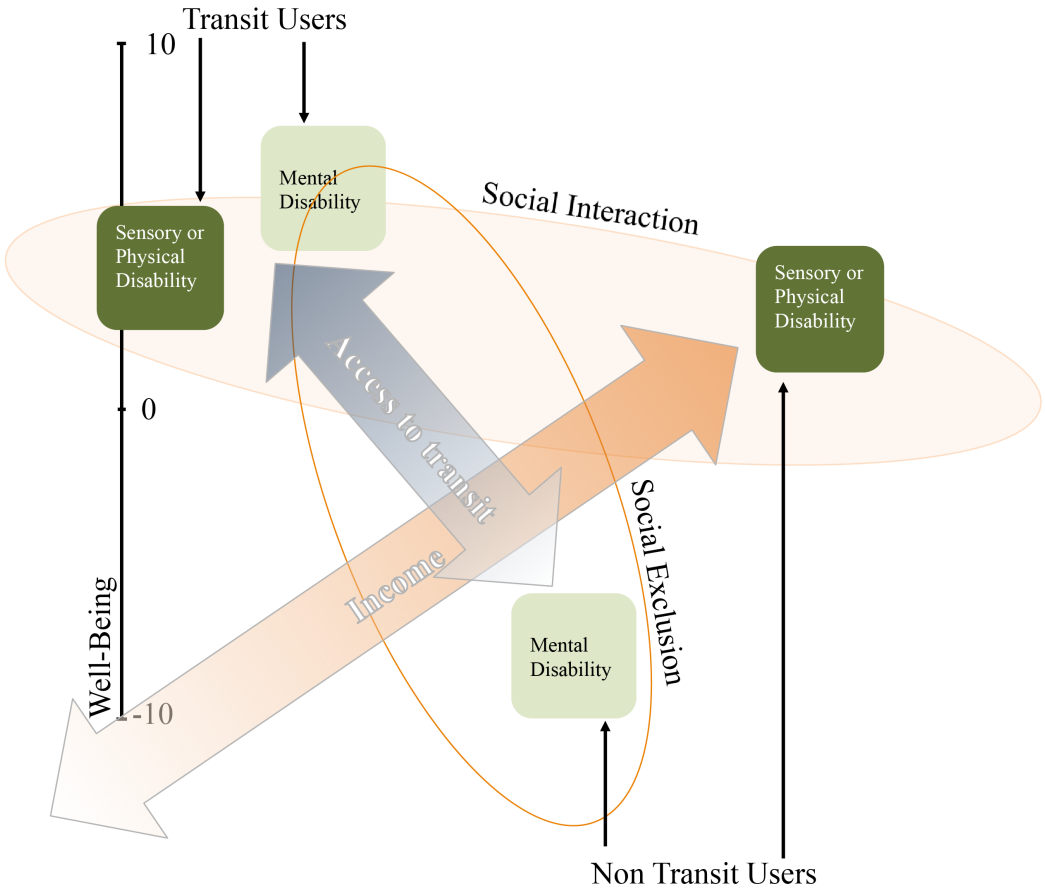


FIGURE 12: Schematic diagram of type of disability, mode choice, access to transit, income, social exclusion and well-being

This study has provided an analysis of the responses to PALS 2006 with an emphasis on the transportation module of the dataset. This is the first known instance of this type of analysis. While the PALS 2006 dataset is an extremely comprehensive survey, the Statistics Canada confidentiality requirements for using the dataset did pose some challenges in the analysis.

Having had less stringent confidentiality requirements may have revealed more about the transportation needs and difficulties of people with disabilities. However, the importance of the confidentiality requirements for respecting the privacy of Canadians who filled out the PALS survey is recognized and understood.

Had time permitted, this study could have benefited from an in-depth investigation of the application of communication technologies to assist people with mental/cognitive disabilities in transportation. Since 2000 a number of pilot project have been done on this topic and a scan of the state-of-the art in this area would be of benefit to researchers.

6. CONCLUSION

The research behind this paper has uncovered a wealth of information on transportation, well-being and disability. The review of definitions, concepts and trends has shown that there are two ways to define disability. It can be defined a) as an individual's condition or impairment affecting the ability to complete essential activities; or b) or as socially imposed barriers that create exclusion. From the human rights perspective, it is important to ensure that all members of society are treated equally. The objective should not be to treat everyone the same, but to recognize and accommodate differences in order to ensure equal treatment and equal access to opportunities. This can be complex when trying to accommodate the transportation needs of a people with mental/cognitive disabilities.

Mental/cognitive disabilities cover a wide range of conditions that are often unseen. These types of disabilities can significantly impact an individual's ability to completed essential daily activities. Strong social support networks and positive attitudes as well as access to transportation can help to enhance independence and quality of life for people with mental/cognitive disabilities. Results of the statistical analysis of this study indicate that people with mental/cognitive disabilities are younger and have less income than people with sensory and physical disabilities. The statistical analysis also found that access to transit has a significant impact on well-being, especially for people with mental/cognitive disabilities. Access to transit has a greater impact on well-being than level of income. Not having access to transit and not being able to afford personal transportation is detrimental to well-being and can lead to social exclusion. Built environments that facilitate walking and with enough density to support reliable and frequent transit

options will ensure the greatest participation in society for people with disabilities. This is particularly true for people with mental/cognitive disabilities, who face an added barrier of having lower incomes and not being eligible for paratransit. Accommodating the transportation needs of people with mental/cognitive disabilities by providing access to transit will go a long way in ensuring their full and equal participation in society.

7. REFERENCES

An, S., Roessler, R., & McMahon, B. (2011). Workplace discrimination and Americans with psychiatric disabilities: A comparative study. *Rehabilitation Counseling Bulletin, 55*(1), 7-20.

Arthanat, S., Nochajski, S., & Stone, J. (2004). The international classification of functioning, disabilities and health and its application to cognitive disorders *Disability and Rehabilitation, 26*(4), 235-245.

Davies, D., Stock, S., Holloway, S., & Wehmeyer, M. (2010). Evaluating a GPS-based transportation device to support independent bus travel by people with intellectual disability. *Intellectual and Developmental Disabilities, 48*(6), 454-464.

Department of Justice Canada. (1982). *Constitution act*. Ottawa, Canada: Minister of Justice Retrieved from http://laws-lois.justice.gc.ca/eng/Const/index.html.

Duarte, A., Garcia, C., Giannarakis, G., Limão, S., Polydoropoulou, A., & Litinas, N. (2009). New approaches in transportation planning: happiness and transport economics. *NETNOMICS: Economics Research and Electronic Networking, 11*(1), 5-33.

Fischer, G., & Sullivan, J. (2002). *Human centered public transportation systems for persons with cognitive disabilities: Challenges and insights for participatory design* Paper presented at the Participatory Design Conference Malmo, Sweden.

Health Canada. (2002). A report on mental illnesses in Canada. Ottawa, Canada Health Canada

Human Resources Development Canada. (2003). *Defining disabilit: A complex issue*. (RH37-4/3-2003E). Gatineau, Canada Human Resources Development Canada.

Hunter-Zaworski, K. (1993). Improving bus accessibility systems for persons with sensory and cognitive impairments (F. T. Administration, Trans.) (pp. 85). Washington, DC: Federal Transit Administration.

International Transport Forum. (2009). Cognitive impairment, mental health and transport: Design with everyone in mind. Paris, France: International Transport Forum.

Kim, S., & Ulfarsson, G. (2013). *Transportation in an aging society: The linkage between transportation and quality of life*. Paper presented at the Annual Meeting of the Transportation Research Board, Washington DC.

Kim, T., Choo, S., Shin, Y., & You, S. (2013). *Identifying differences of travel time budgets between the elderly and the non-elderly groups using PSL-structural equation models: A case Study for Seoul metropolitan area*. Paper presented at the Annual Meeting of the Transportation Research Board, Washington DC.

Krizek, K., & El-Geneidy, A. (2007). Segmenting preferences and habits of transit users and non-users. *Journal of Public Transportation, 10*(3), 71-95.

Lamont, D. (2010). *Understanding and addressing dyslexia in transport provision*. Paper presented at the International Conference on Mobility and Transport for Elderly and Disabled Persons, Hong Kong.

McCluskey, M. (1988). Rethinking equality and difference: Disability discrimination in public transportation. *The Yale Law Journal, 97*(Yale L.J. 863), 863-881.

Risser, R., Iwarsson, S., & Ståhl, A. (2012). How do people with cognitive functional limitations post-stroke manage the use of buses in local public transport? *Transportation Research Part F, 15*, 111-119.

Rosenkvist, J., Wendel, K., Stahl, A., Risser, R., & Iwarsson, S. (2007). *Public transport planning from the perspective of people with cognitive functional limitations*. Paper presented at the International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED 2007), Montreal, Canada.

Rutenberg, U., Arnold, A., & Wallersteiner, U. (1999). Assessment of in-cabin information technologies for passengers with sensory and cognitive impairments. Montreal, Canada: Transport Canada, Transportation Development Centre.

Sammer, G., Uhlmann, T., Unbehaun, W., Millonig, A., Mandl, B., Dangschat, J., & Mayr, R. (2012). *Identification of mobility impaired persons and analysis of their travel behaviour as well as their needs*. Paper presented at the Annual Meeting of the Transportation Research Board, Washington DC.

Scheid, T. (2005). Stigma as a barrier to employment: Mental disability and the Americans with disabilities act. *International Journal of Law and Psychiatry, 28*, 670-691.

Statistics Canada. (2007). Participation and activity limitation survey 2006: Analytical report (M. o. Industry, Trans.) *Analytical Paper* (Vol. 002). Ottawa: Statistics Canada

Statistics Canada. (2011). *Participation and activity limitation survey public use microdata file user guide*. (12M0021G). Ottawa Statistics Canada Health Statistics Division

Suen, L., & Chan, H. (2013). *Mobility for travelers with attention deficit hyperactivity disorder and learning disabilities: Challenges and solutions*. Paper presented at the Annual Meeting of the Transportation Research Board, Washington DC.

Suen, L., McInerney, P., & Barkow, B. (1992). *Travel difficulties related to vision, hearing and cognitive/emotional disability*. Paper presented at the International Conference on Mobility and Transport for Elderly and Disabled Persons, Lyon, France.

Turcotte, M., & Schellenberg, G. (2006). *A portrait of seniors in Canada*. (89-519-XIE). Ottawa, Canada: Statistics Canada.

Turnbull, A., & McKenzie, J. (1998). Technologies for travellers with Sensory or Cognitive Disabilities In T. D. C. Transport Canada (Ed.). Montreal, Canada: Transport Canada

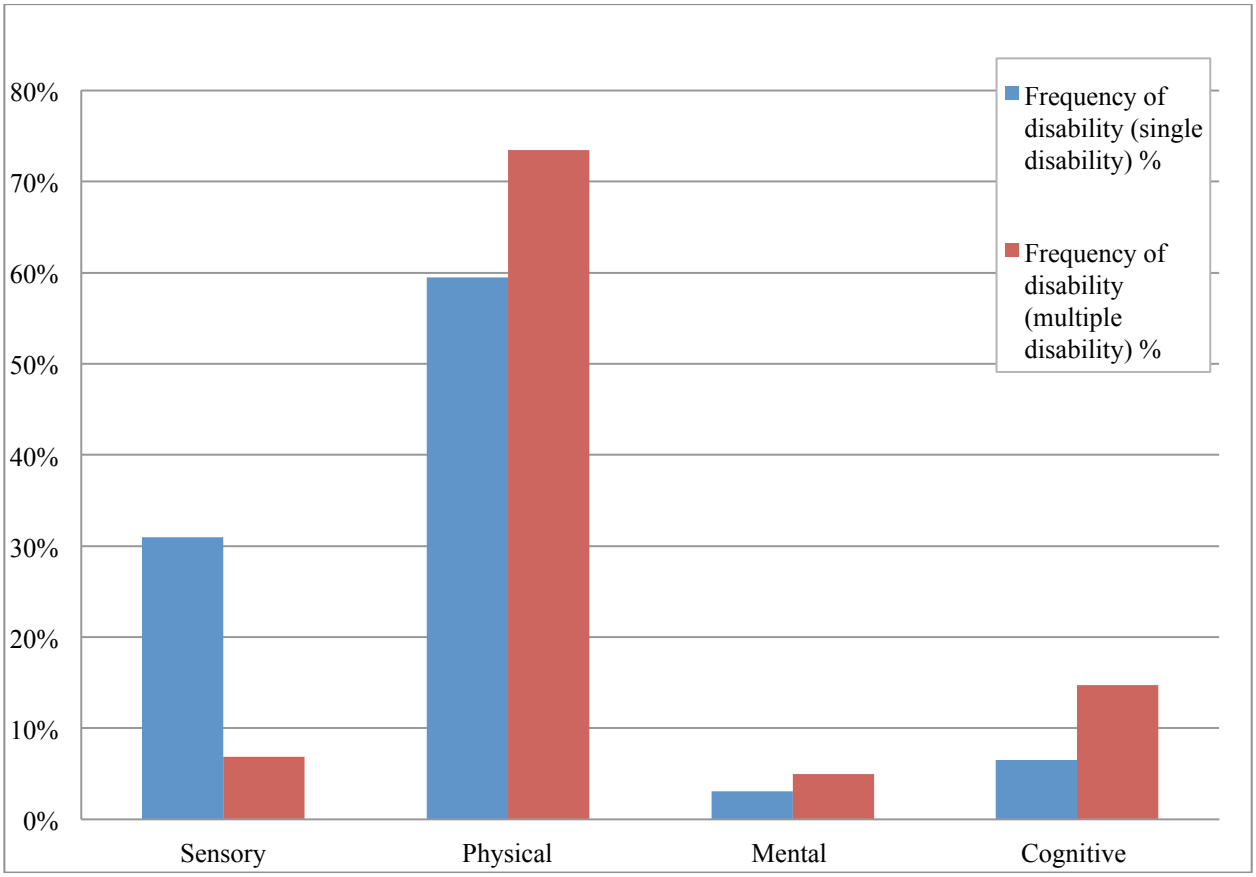
Ustun, T., Chatterji, S., Bickenbach, J., Kostanjsek, N. , & Schneider, M. (2003). The international classification of functioning, disability and health: A new tool for understanding disability and health. *Disability and Rehabilitation, 25*(11-12), 565-573.

Waara, N., & Ståhl, A. (2004). *the need for information in public transport*. Paper presented at the International Conference on Mobility and Transport for Elderly and Disabled Persons (TRANSED 2004), Hamamatsu, Japan.

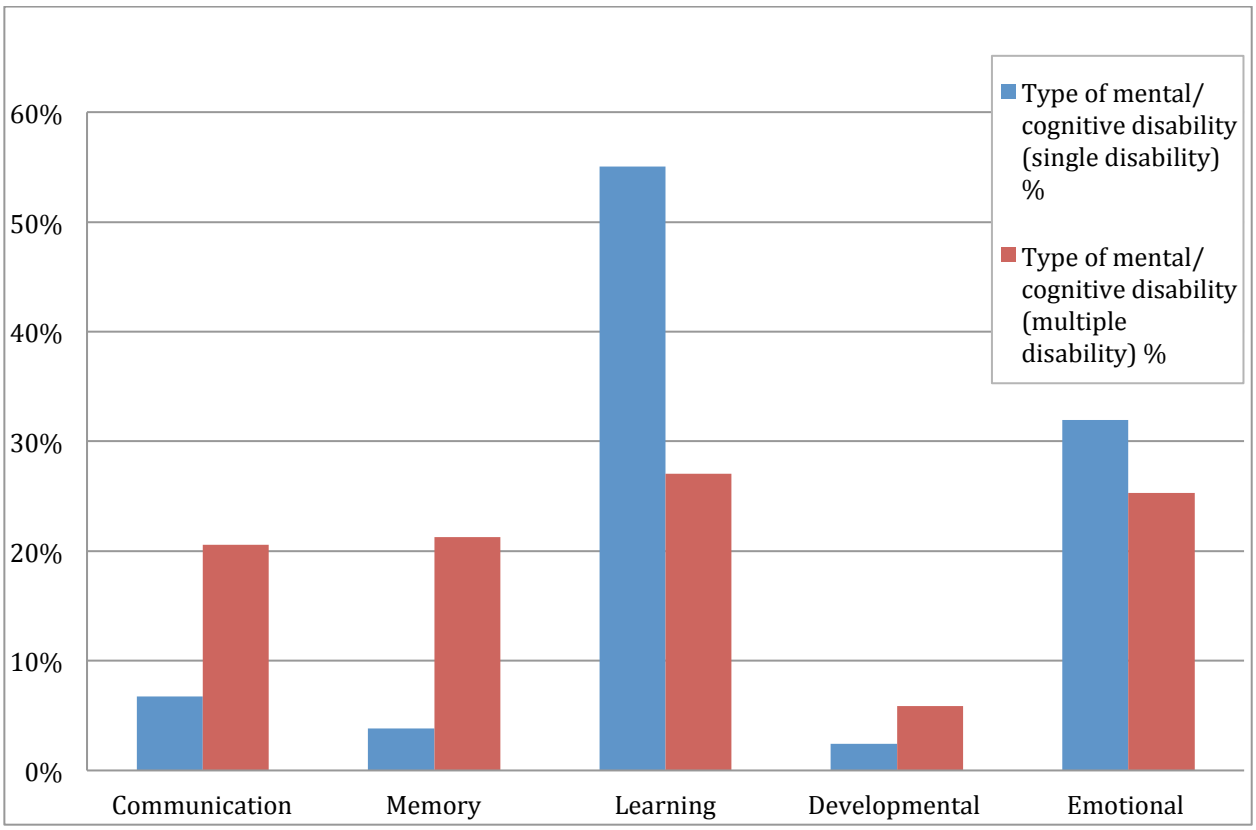
Wasfi, R., Levinson, D., & El-Geneidy, A. (2006). *Measuring the transportation needs of people with developmental disabilities*. Paper presented at the Annual Meeting of the Transportation Research Board, Washington DC.

World Health Organization and World Bank. (2011). World report on disablity In A. O. a. A. Posarac (Ed.). Geneva, Switzerland World Health Organization and World Bank.

8. APPENDIX



APPENDIX A: Frequency of PALS respondents who reported having a single disability vs frequency of respondents who reported having multiple disabilities.

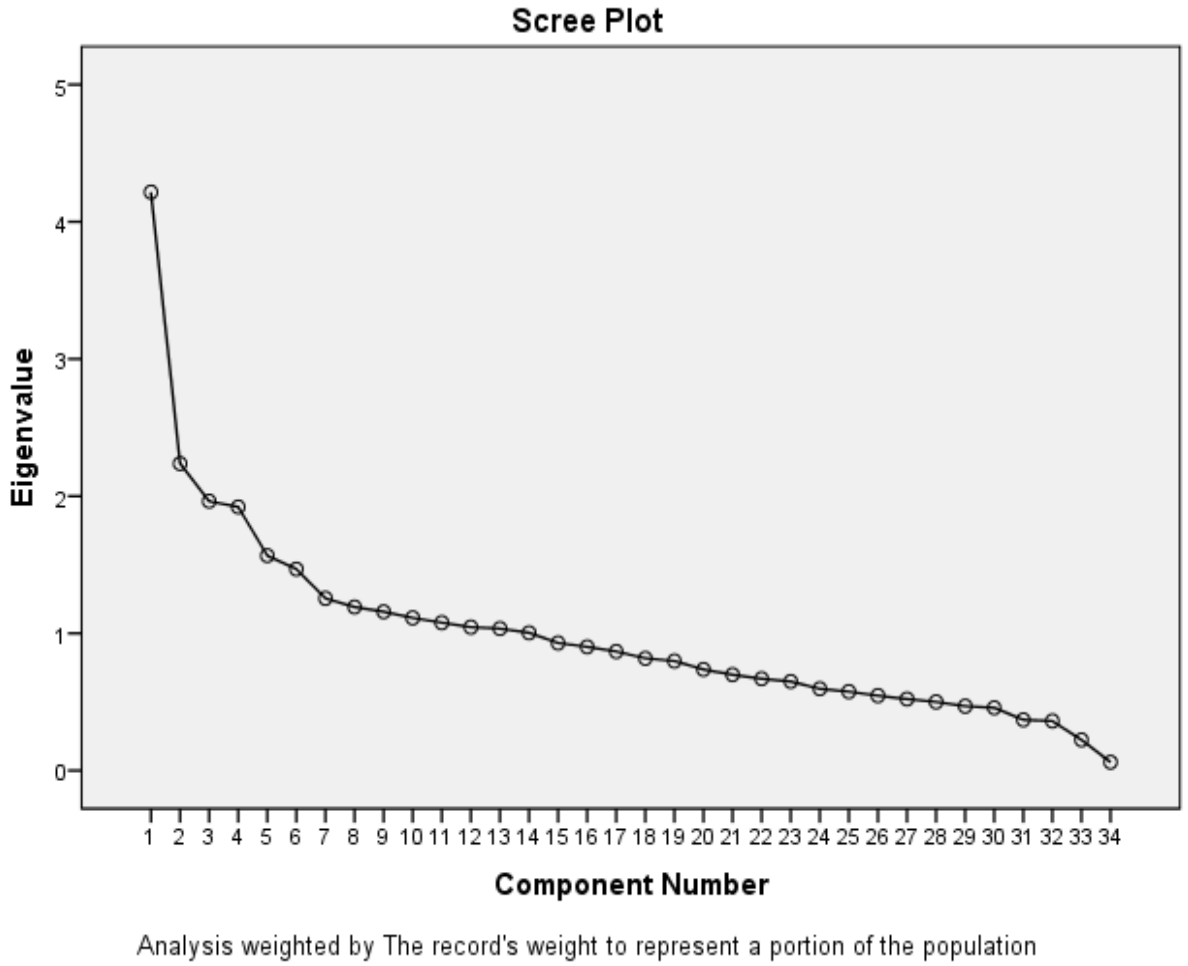


APPENDIX B: Frequency of PALS respondents who reported having a single mental/cognitive disability vs frequency of respondents who reported having multiple mental/cognitive disabilities

Total Variance Explained

Component (Factors)	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.216	12.400	12.400	4.216	12.400	12.400	3.085	9.074	9.074
2	2.237	6.580	18.979	2.237	6.580	18.979	2.413	7.097	16.171
3	1.963	5.773	24.752	1.963	5.773	24.752	1.874	5.513	21.684
4	1.921	5.650	30.402	1.921	5.650	30.402	1.696	4.989	26.673
5	1.566	4.607	35.009	1.566	4.607	35.009	1.657	4.874	31.547
6	1.468	4.318	39.328	1.468	4.318	39.328	1.654	4.864	36.412
7	1.255	3.692	43.020	1.255	3.692	43.020	1.563	4.596	41.007
8	1.192	3.506	46.526	1.192	3.506	46.526	1.448	4.260	45.268
9	1.157	3.403	49.929	1.157	3.403	49.929	1.295	3.809	49.076
10	1.113	3.273	53.202	1.113	3.273	53.202	1.201	3.532	52.609
11	1.078	3.169	56.371	1.078	3.169	56.371	1.173	3.449	56.058
12	1.045	3.073	59.444	1.045	3.073	59.444	1.101	3.237	59.296
13	1.034	3.042	62.486	1.034	3.042	62.486	1.082	3.182	62.478
14	1.004	2.953	65.439	1.004	2.953	65.439	1.007	2.961	65.439
15	.930	2.735	68.174						
16	.902	2.652	70.827						
17	.867	2.551	73.378						
18	.818	2.406	75.784						
19	.798	2.347	78.130						
20	.737	2.167	80.297						
21	.699	2.055	82.352						
22	.669	1.968	84.321						
23	.649	1.910	86.231						
24	.596	1.752	87.983						
25	.575	1.692	89.675						
26	.546	1.605	91.280						
27	.522	1.534	92.814						
28	.500	1.471	94.286						
29	.469	1.380	95.666						
30	.458	1.347	97.013						
31	.370	1.087	98.100						
32	.361	1.063	99.162						
33	.224	.659	99.821						
34	.061	.179	100.000						

APPENDIX C: Eigen values and variance resulting from factor analysis.



APPENDIX D: Factor analysis Scree plot.

Factor Groups	Transit users		Non transit users	
	Mental disability	Sensory/physical disability	Mental disability	Sensory/physical disability
Pressures	0.59	1.01	1.42	1.26
Earning potential	-1.10	-3.02	0.91	8.07
Well-being	2.26	1.30	-4.25	0.74
Social interaction	-0.03	2.01	-2.13	1.41
Transit use	0.85	2.66	-1.36	-0.95
Paratransit use	0.26	2.68	-0.90	0.08
Travel barriers	0.05	-0.29	1.22	0.69
Hearing disability	-0.10	1.41	0.06	3.76
Mobility disability	-0.12	1.05	0.24	0.60
Agile	0.25	-0.15	-0.63	-0.54
Mental disability	7.70	-1.40	3.32	-0.75
Communication disability	-0.22	0.09	0.66	-0.17
Memory disability	-0.01	0.52	2.43	-0.15
Developmental disability	0.00	-0.34	0.09	-0.50

APPENDIX E: Value of cluster centers resulting from cluster analysis on factors.