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Are we leaving some people behind? Travel autonomy, perceived accessibility, and well-being among people experiencing mental and physical difficulties

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ABSTRACT

This study focuses on the association between cognitive, medical, and physical difficulties; mental illness; travel autonomy; and perceptions of the possibilities of participating in desired daily activities; further, we examine their association with happiness and life satisfaction. We present and empirically test an integrated framework with travel autonomy, defined as the prerequisites, freedom, and possibility to travel the way one wants, at its core. We use web survey data (n = 1041) collected in Sweden in 2021. Using partial least squares structural equations, we find a valid and reliable model with travel autonomy as a distinct and reliable latent construct. Furthermore, travel autonomy yields significant paths to perceived accessibility, happiness, and life satisfaction, highlighting the importance of capabilities, independent travel, freedom, and possibilities in the overall construct of travel autonomy. Finally, mental illness plays an important role in how people rate their travel autonomy.

1. Introduction

Disability is a complicated and multidimensional concept (Altman, 2001) often described as a continuum rather than an absolute state. It involves the dynamic relationship between functioning and environmental/social context. We focus on the association between disability, mental illness, travel autonomy, and perceptions of the possibilities of participating in desired daily activities; further, we examine their association with happiness and life satisfaction. Our interest in these relationships is grounded in a vital societal challenge; according to the World Health Organization (2011), approximately 15% of the world's population (aged 15 years and older) has significant difficulties in functioning. Moreover, the number of people with one or more disabilities is expected to double by 2050 primarily due to an ageing population and increase in chronic health conditions (World Health Organization, 2011). The individual is also at the heart of the 'leaving no one behind' principle and an overarching objective of the 2030 Agenda (United Nations Sustainable Development Group, 2022). Thus, we need to further understand the experiences of living a satisfying life among people with mental and physical difficulties.

Disability does not have a uniform definition, with definitions varying depending on the perspective, from clinical to social or a combination of both (Shen et al., 2023). As Ralph, Morris, and Kwon (2022) noted, there are also different views on linguistics, such as whether to use 'disabled people' or 'people with disabilities'; the former emphasises the disabling impact of interactions with the environment, while the latter considers it as one (of several) personal characteristics. Here, we focus on individuals' perceptions of

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their own difficulties in various domains, which can be related to both personal characteristics and the interactions with the environment.

Scholars have also discussed how to measure and classify a person as disabled. Some favour binary measures, whereas others recommend threshold levels (Bourke et al., 2021; Palmer & Harley, 2012). Hence, classifications are dependent on the choice of measure or threshold level (Bourke et al., 2021). Consequently, one person may be classified as disabled by a binary measure, but not by a specific threshold level. We acknowledge the relevance of this debate and that the choice of measures is important for both the individuals being classified and policy. Our primary focus is on individuals who have experienced difficulties in daily life, and not on labelling someone as disabled or non-disabled.

Lifestyle-related factors, older age, low physical and cognitive functioning, and psychological conditions (e.g. mental health disorders) increase the risk of experiencing difficulties in daily life. During their lifetime, almost everyone is likely to experience some form of difficulty, either temporarily or permanently. For most people, participation in daily out-of-home activities is fundamental to a rich and meaningful life. However, inaccessible environments (including transportation systems) may create barriers to participation in out-of-home activities, particularly for those who have difficulties in functioning. People with difficulties make approximately 10–30% fewer trips than those without disabilities (Park et al., 2022). Furthermore, those with disabilities pay a time premium as they have to spend 10–50% more time on travelling for each minute of out-of-home activity (Ralph, Morris, & Kwon, 2022).

Individuals with disabilities are also more dependent on public transit systems. Hence, poor reliability, maintenance, and weak information make such modes less usable, particularly for those with visual and cognitive impairments, as well as for those with mental illness (Bezyak, Sabella, & Gattis, 2017; Park et al., 2022). Park et al.'s (2022) review concluded that failure to acknowledge various disabilities will lead to planning that does not match needs, potentially causing poor infrastructure decisions and transportation-related injustices. Many transport authorities and governments recognise that having the possibility to travel without hindrance is crucial for people to work, study, and participate in community activities on equal terms not only due to inclusion and equity considerations but also from a well-being perspective (e.g. Hunhammar et al., 2019). Therefore, accessibility is an important aspect.

Accessibility is a multidimensional concept that is often operationalised using objective indicators. This can be a limitation, as it may result in flawed interpretations where the needs, experiences, and desires of individuals tend to be overlooked. This has led to the development of an approach for assessing and understanding perceived accessibility (Curl, 2013; Curl et al., 2015; Lättman et al., 2018; Pot et al., 2021). Perceived accessibility is defined as 'the possibility to live the life one wants with the help of the transport system' (Lättman, Olsson, & Friman, 2016, p.16). Perceived accessibility is significantly associated with both satisfaction with daily travel and well-being (Lättman, Olsson, & Friman, 2020). Barriers to daily travel may be related to perceptions of independence and freedom of mobility, which can lead to lower social inclusion and reduced quality of life (Park et al., 2022). Indeed, the relationship between daily travel and well-being in children, adults, and the elderly has been well documented over the past ten years (e.g. Friman et al., 2018; Chatterjee et al., 2020). However, few empirical studies examine travel autonomy, perceived accessibility, and well-being among people experiencing cognitive, physical, medical, and mental health difficulties.

We argue that travel autonomy involves individuals possessing control over the various aspects of their daily travel. Choices, free will, and the control over actions are essential parts of human nature (for an excellent overview of free will in consumer, see Baumeister, Sparks, Stillman, & Vohs, 2008). Here, we capture its complexity and flexibility in travel autonomy. We argue that travel autonomy can improve life and contribute to well-being. Perceived accessibility is related to travel autonomy in that it focuses on the possibility of living one's desired life, which is a known determinant of well-being (Lättman et al., 2019).

In summary, the transport system, in particular, and society, in general, need better inclusion, especially for people experiencing mental and physical difficulties. Here, we ask if we are leaving some people behind. We strive to present some answers by focusing on the experiences of travel autonomy, perceived accessibility, and well-being among people with mental and physical difficulties.

2. Conceptualisation

Geurs and Ritsema van Eck (2001) defined accessibility as a multidimensional concept in which a transport system enables individuals to perform activities or reach destinations by utilising a (combination of) transport mode(s). This definition includes land-use, transport, temporal, and individual dimensions, which act together to determine the degree of accessibility. These dimensions are typically based on spatial indicators (also known as calculated or objective accessibility indicators). Recent research has revealed discrepancies between calculated measures of accessibility and how individuals perceive their own accessibility (Curl, 2013; Curl et al., 2015; Lättman et al., 2018; Pot et al., 2021). Hence, a narrow focus on calculated indicators can lead to an incomplete picture; consequently, our knowledge of how different policies and transport investments for increased inclusion affect individual accessibility may be flawed.

Empirical studies focusing on accessibility and disability have shown that the design of facilities and infrastructure are common barriers (e.g. Kirchner et al., 2008; Rosenberg et al., 2013). Some studies have explored the provision of services, including personal assistance and assistive technology (e.g. Hästbacka et al., 2016; Rimmer et al., 2004). Maisel et al. (2021) showed that people with disabilities consistently rate built environment factors (distances and physical barriers in the pedestrian environment) as more important to their transit mode decision-making than scheduling-related factors (e.g. number of transfers or departure times). Focusing on people registered in a US disability community, the authors also highlight the importance of addressing complex trips while assisting riders with intellectual and cognitive difficulties; people experiencing difficulties face different barriers depending on where they live, suggesting the need for context-sensitive information. Park et al.'s (2022) review revealed several specific barriers that hinder people with disabilities in their travel, where travel modes, travel times, and trip frequency contribute to an inaccessible transport system. Consequently, people with disabilities make 10–30% fewer trips than those without disabilities. An online survey of

Sendai metropolitan area residents (Japan) asked them about their sense of accessibility ('I can do whatever I want with my usual means of transportation') and self-rated health (Tanimoto & Hanibuchi, 2021). The results showed that self-rated health was significantly and positively correlated with the sense of accessibility. Thus, good health seems to go hand-in-hand with the feeling of being able to do what one wants with the help of a selected transportation mode(s).

Another potentially important mechanism for people with disabilities is travel autonomy. Travel autonomy is related to but distinctly separate from perceived accessibility. Autonomy has various definitions, such as 'independence' (Oxford Learner's Dictionary, n.d.), 'the quality or state of being self-governing' (Merriam-Webster, n.d.), or 'the power to make your own decisions' (MacMillan Dictionary, n.d.). Autonomy is a core psychological need (Deci & Ryan, 2012) that affects well-being. It has been integrated into several micro-theories of basic psychological needs, with a primary focus on social contexts and the workplace (Deci et al., 2017). Notably, it has also been successfully applied to healthcare, education, sports, physical activity, management (Ryan & Deci, 2017), and recently, work commutes (Gerpott, Rivkin, & Unger, 2023). The individual dimension of accessibility captures how people perceive the accessibility of the transport system, whereas travel autonomy emphasises capabilities, decision latitude, and independence–the prerequisites–freedom, and the possibility to travel the way one wants. At its core, travel autonomy involves individuals possessing control over the various aspects of their daily travel.

Building on a research gap regarding the degree of various difficulties, travel autonomy, and perceived accessibility, we propose a conceptual model that visualises these concepts and their associations with well-being (see Fig. 1). This conceptual model divides well-being into happiness and life satisfaction. Happiness generally refers to the affective dimension of well-being, whereas life satisfaction is a cognitive or calculative evaluation of one's life as a whole (Diener & Suh, 1997). Transport research has typically focused on the role of travel mode use, travel attributes, and travel satisfaction for well-being (see reviews by Ettema et al., 2016; De Vos et al., 2013; Zhu & Fan, 2018), with few exploring travel autonomy and well-being, or perceived accessibility and well-being. Moreover, few studies have explicitly included people who experience physical, medical, and cognitive difficulties, or mental illnesses.

Research that inspired the development and provided support for the conceptual model is primarily related to independent travel. A study of (healthy) children in Japan, Canada, and Sweden concluded that independence, as in being allowed to autonomously decide how to travel, was positively associated with life satisfaction (Waygood et al., 2019). Another study of a general adolescent population in Australia observed that independence and autonomy were related to mental well-being, with greater independence and autonomy being associated with higher mental well-being (Delbosc & Vella-Brodrick, 2015). Similarly, travel autonomy becomes more important among the elderly when functional limitations become prevalent; this is because being able to participate in activities outside the home is vital for mental and physical health, well-being and quality of life (Portegijs et al., 2014).

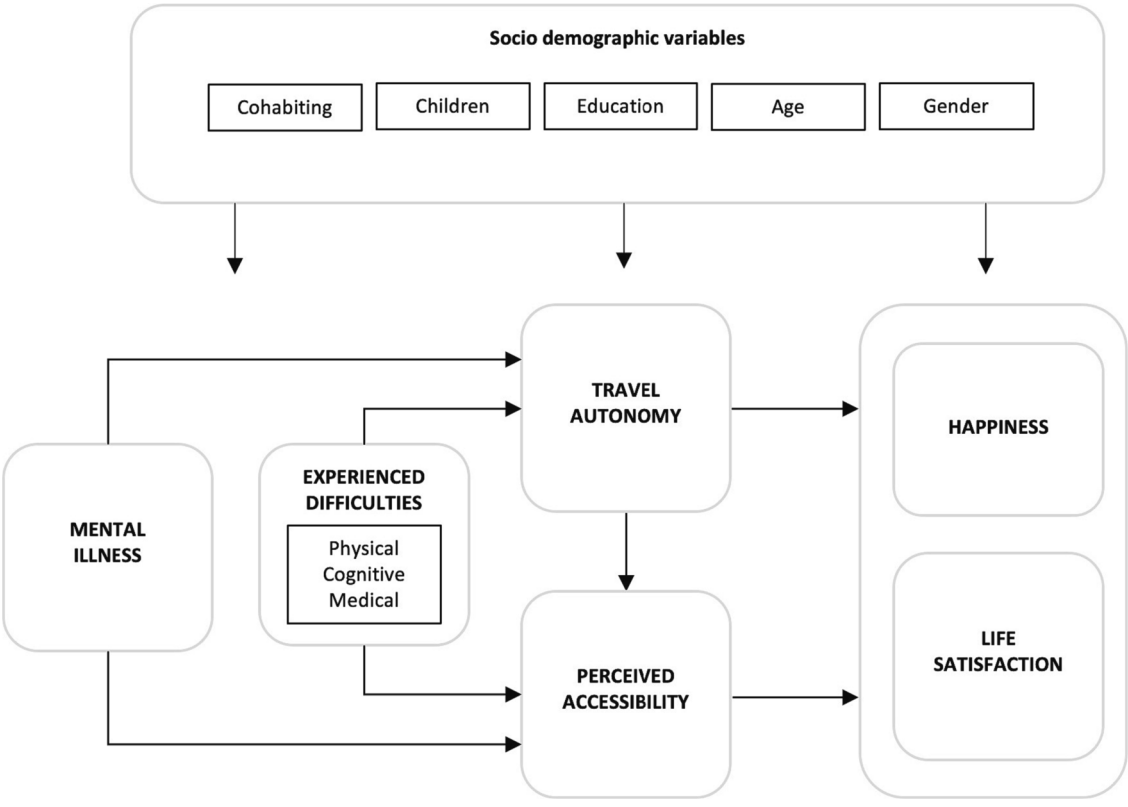

Fig. 1. Conceptual model of relationships between mental illness, experienced difficulties, travel autonomy, accessibility, happiness, and life satisfaction.

The conceptual model (Fig. 1) visualises the proposed association between travel autonomy, perceived accessibility, and an individual's well-being in life. One hypothesis is that low (or high) travel autonomy and low (or high) perceived accessibility are associated with low (or high) well-being. The model also predicts an indirect association between travel autonomy and well-being via perceived accessibility. This implies that a low (or high) degree of free will and self-control in travel can affect the perceived possibilities and options for participating in activities of choice, which in turn can decrease (or increase) well-being in life. Travel autonomy and perceived accessibility are, in turn, dependent on experienced difficulties and mental illness; those experiencing difficulties and mental illness are likely to have lower perceived accessibility and travel autonomy. The model also predicts that certain sociodemographic variables can influence the variables in the model. Although not an exclusive list, important sociodemographic variables can include cohabitation, children, education level, age, and gender.

In summary, the ability to access opportunities and autonomy to travel enables social interactions, employment, cultural experiences, and other goal-fulfilling activities which are important for people's well-being in life. This study examines the associations identified in the conceptual model by analysing survey data on the general population in Sweden.

3. Data and method

3.1. Sample

The data were collected during 2021 through e-mails with a link to the questionnaire sent out by an international survey company to a representative sample of participants voluntarily registered in an 'Audience Online Panel' living in Stockholm (the capital of Sweden, with approximately 1.5 million inhabitants) and Karlstad (a small-to-middle-sized city in Sweden with approximately 100,000 inhabitants). The cities were chosen because they represent both more and less dense areas with access to public transportation. Participants (n = 1041) were informed about their anonymity, volunteerism, and their right to drop out at any time. All procedures were performed in compliance with regulations and institutional guidelines, including appropriate institutional committee approval and approval from the Swedish National Ethics Board of the Swedish Research Council (Dnr 2021–03762). After completing the questionnaire, the participants were offered points that could be exchanged for gift cards or donated to charity. In the questionnaire, participants were asked about sociodemographic factors, travel autonomy in their daily travel, perceived accessibility, happiness in life, and life satisfaction. They also self-reported the existence of experienced difficulties and degree of mental illness.

Table 1 presents the descriptive statistics of participants. A set of additional variables was collected from separate blocks of the survey. These are not presented here because they are beyond the scope of this study. The survey took approximately 15 min to complete.

3.2. Primary variables

As shown in Fig. 1, besides sociodemographic control variables, we had six primary variables: self-reported difficulties, mental illness, travel autonomy, perceived accessibility, happiness, and life satisfaction.

Self-reported difficulties is an operationalisation of the degree of disability and was measured using three scales in which participants reported difficulty related to (1) medical health ('To what extent do you have impaired medical health that is permanent or long-lasting, and complicates your everyday life?'), (2) physical difficulties ('To what extent do you have problems with your ability to move, see, or hear that are permanent or long-lasting, and make your everyday life difficult?'), and (3) cognitive difficulties ('To what extent do you have problems with language or numbers, concentration, or memory, which are permanent or long-lasting, and make your everyday life difficult?'). Participants provided their responses on a scale of 1 to 7 (1 = To a very low degree, 7 = To a very high degree). Questions on self-reported difficulty have been used in a major Swedish national survey of daily travel (Trafikanalys, 2019).

Table 1
Descriptive statistics of the study participants in Karlstad and Stockholm.

		Karlstad (n = 504)		Stockholm (n = 537)	
Age		**Mean**	**Sd**	**Mean**	**Sd**
		49.4	19.3	46.9	17.3
Gender		**N**	**%**	**N**	**%**
	Man	231	45.8	279	52.0
	Woman	273	54.2	258	48.0
Children Living at Home					
	No	356	70.6	396	73.7
	Yes	148	23.8	141	26.3
Cohabiting					
	No	176	34.9	235	43.8
	Yes	328	65.1	302	56.2
Education					
	No university	190	37.7	181	33.7
	University less than three years	113	22.4	93	17.3
	University three or more years	201	39.9	263	49.0

These three scales were included in the model as separate constructs to capture whether different types of difficulties played different roles.

Mental illness was measured using the Mental Health Index MIH-5, a reliable and widely used measure of general mental health status often used in public health surveys (Strand et al., 2003). The scale consists of five questions focusing on different aspects of mental illness (mental well-being), primarily capturing mood and anxiety (Rumpf et al., 2001) as experienced during the last month, and phrased as: 'During the last month, how often have you …' (1) 'felt very nervous?', (2) 'felt so low that nothing could cheer you up?', (3) 'felt calm and harmonic?' (reverse coded), (4) 'felt depressed and sad?', and (5) 'felt glad?' (reverse coded). The questions were answered on five-point scales ranging from 1 (never) to 5 (very often). Composite reliability (CR) of the five items was satisfactory (CR = 0.90).

Travel autonomy is a scale developed by the authors to measure four statements capturing different aspects of autonomy related to daily travel: capability, prerequisites, freedom, and possibilities. The statements are inspired by the psychological needs defined in self-determination theory (Deci & Ryan, 2012; Ryan & Deci, 2017). Each statement started with 'To what degree do you have…' and was followed by (1) 'capability to travel as you wish, (2) prerequisite to travel independently without help from others, (3) freedom to travel as you wish, and (4) possibility to travel as you wish'. Each of the four statements was measured on a seven-point scale ranging from 1 (never) to 7 (always). The CR of the four items was satisfactory (CR = 0.90).

Perceived accessibility was measured using the Perceived Accessibility Scale (PAC) developed by Lättman et al. (2016). The scale consists of four statements that capture the ease of travel (1: 'Considering how I travel today, it's easy to do (daily) activities'), ability to live one's desired life (2: 'Considering how I travel today, I'm able to live my life as I want to'), access to preferred activities (3: 'Considering how I travel today, I'm able to do all the activities I like to do'), and quality of access to activities (4: 'Considering how I travel today, access to all the things I want to do is very good'). Responses to the questions ranged from 1 to 7 (1 = I disagree, 7 = I completely agree). The CR of the five items was satisfactory (CR = 0.94).

Happiness was measured by a single item phrased as, 'In general, how happy would you say that you are?' and answered on a seven-point scale ranging from 1 (very unhappy) to 7 (very happy). The validity of single- *versus* multiple-item scales continues to be debated, with scholars generally supporting the superiority of multiple-item scales. However, regarding happiness and life satisfaction, single- and multiple-item scales have yielded very similar results often due to the high correlation between items (Pavot & Diener, 1993, Cheung & Lucas, 2014). Hence, single-item scales were used for both happiness and life satisfaction (see, for instance, Haerpfer et al., 2022).

Life satisfaction was similarly chosen to be measured by a single item and phrased as, 'In general, how satisfied are you with the life you live?' and answered on a seven-point scale ranging from 1 (very dissatisfied) to 7 (very satisfied).

3.3. Sociodemographic control variables

Five sociodemographic variables were included: age (continuous), gender (male *versus* female), cohabitation (single *versus* cohabiting household), education (no university *versus* less than three years of university *versus* three years or more of university), and children living at home (no *versus* yes - always *versus* yes - more than one week per month *versus* yes - less than one week per month). The last question was recorded as a dichotomous variable (children living at home, yes *versus* no).

3.4. Data analyses

The proposed conceptual model (Fig. 1) is tested using partial least squares structural equation modelling (PLS-SEM). PLS-SEM is a method based on ordinary least squares (OLS) regressions but with fewer assumptions regarding the distribution of data. PLS-SEM is prediction-oriented and aims to maximise the explained variance in dependent outcomes and constructs. It is especially suited for models including several latent constructs and is appropriate when models are complex, such as when several direct and indirect paths are analysed simultaneously. Furthermore, PLS-SEM is robust in handling non-normal data (Hair et al., 2019), as is often the case for surveys with happiness and life satisfaction data.

The analyses were conducted with the help of SmartPLS software (Ringle et al., 2022), and executed in five steps: (1) testing the reliability and validity of the constructs, (2) testing the proposed model using the PLS-SEM algorithm with a bootstrap procedure of 5,000 replications, (3) testing predictive validity by the Stone–Geisser's Q2 value using the blindfolding procedure, (4) testing the strength of paths in the measurement model (direct and indirect effects), and (5) running a finite mixture (FIMIX) analyses of the partial least square-model to identify potential segments in the data (such as city differences). If the FIMIX indicates potential segmentation of the data, segments would be identified and analysed using a follow-up multigroup analysis (PLS-MGA) of the paths in the model (Hair et al., 2019).

4. Results

Table 2 presents the descriptive statistics for the primary variables. Although experienced difficulties were generally at very low levels, a substantial number of respondents still reported experiencing difficulties in everyday life, at least to some extent. Counting

Table 2
Descriptive results of the primary variables.

	Item	Mean	Sd	Range	Composite Reliability
Mental Illness (MHI-5)					0.90
	Nervous	2.37	1.00	1–5	
	Low	1.96	1.01	1–5	
	(un)Calm	2.56	0.98	1–5	
	Sad	2.43	0.85	1–5	
	(un)Glad	2.30	0.81	1–5	
Experienced Difficulty					
	Cognitive	1.98	1.51	1–7	
	Medical health	2.68	1.86	1–7	
	Physical	2.42	1.76	1–7	
Travel Autonomy					0.90
	Capability	5.34	1.51	1–7	
	Prerequisite	5.16	1.53	1–7	
	Freedom	5.52	1.48	1–7	
	Possibility	6.13	1.37	1–7	
Perceived Accessibility (PAC)					0.94
	Easy to do activities	5.65	1.34	1–7	
	Live life as I want	5.40	1.50	1–7	
	Able to do all activities	5.39	1.61	1–7	
	Access is very good	5.39	1.49	1–7	
Happiness					
	In general	5.01	1.30	1–7	
Life Satisfaction					
	In general	5.10	1.33	1–7	

those reporting more than 1 on the scale,[1] cognitive, physical, and medical disabilities were reported by 39.6%, 51.0%, and 55.4% of the participants, respectively. Choosing the cutoff point above the midpoint of the scale (5–7 on the 7-point scale), greater cognitive, physical, and medical difficulties were reported by 10.3%, 18.7%, and 22.4% of the participants, respectively. On average, mental illness was similarly reported to be below the midpoint of the scale. Travel autonomy and perceived accessibility were on average, higher than the mid-point of the scales. Similar results were observed for happiness and life satisfaction, consistent with previous research.

The reliability and validity of the constructs were first assessed following the outlined procedure. *Internal consistency*, as measured by CR, was above 0.90 for all constructs; *convergent validity* was established as all outer loadings exceeded the critical value of 0.7; *discriminant validity* was established as the Fornell-Larcker criterion and Heterotrait-monotrait (HTMT) ratios were below the threshold values for all constructs (see Hair et al., 2017). No *multicollinearity* issues were observed for any construct.

Together, these results show that the measured constructs of mental illness, experienced difficulties (cognitive, medical health, and physical), travel autonomy, perceived accessibility, happiness, and life satisfaction had satisfactory validity and reliability. Furthermore, the constructs are theoretically distinct from each other and empirically discriminant from each other; thus, they should be treated as separate, distinct constructs.

Overall, the model was satisfactory, with an SRMR *model fit* value of 0.46 (threshold less than 0.8) and robust R^2 *values* (autonomy: 0.21, perceived accessibility: 0.38, happiness: 0.19, and life satisfaction: 0.21). For the disability and mental illness variables, the R^2 varied between 0.06 and 0.13. *Predictive validity* was found to be satisfactory, with Q^2 values above 0 for all constructs. Hence, the model was regarded as valid and reliable.

Next, we assessed the paths of the structural model. Fig. 2 shows the observed significant direct effects, where only the paths with at least a small effect size (above 0.02) are shown. Table 3 includes a detailed account of all direct effects in the structural model, explicitly yielding standardised path coefficient estimates (β), effect sizes (f^2), t-statistics, p-values, and bias corrected confidence intervals (CI = 95%).

As shown in Table 3, a large number of paths were significant at $p < 0.05$. Several of these have very low effect sizes at less than 0.02, and thus, were considered to be less significant. Meanwhile, several paths were above the effect size threshold (visualised in Fig. 2 and shown in boldface within the grey areas in Table 3). Experiencing medical difficulty had a significantly negative path to travel autonomy, indicating that experiencing less difficulty was positive for autonomy. No significant effects were observed for the remaining paths from experienced difficulty to autonomy and perceived accessibility, thereby not supporting the proposed conceptual model. Mental illness was as important for both autonomy and accessibility, as indicated by the significant negative paths. Hence, an increase in mental illness is related to decreased travel autonomy and perceived accessibility. Mental illness was also indirectly related to perceived accessibility (β = 0.14), happiness (β = 0.10), and life satisfaction (β = 0.11) through travel autonomy. Thus, higher mental illness relates to a lower sense of travel autonomy, which in turn is related to less perceived accessibility, lower happiness, and lower life satisfaction.

[1] As the scale ranged from 'To a very low degree = 1' to 'To a very high degree = 7', those reporting 1 on the scale may also include individuals perceiving no difficulties at all. For those reporting 2 and above, we can be assured that at least some difficulties are present.

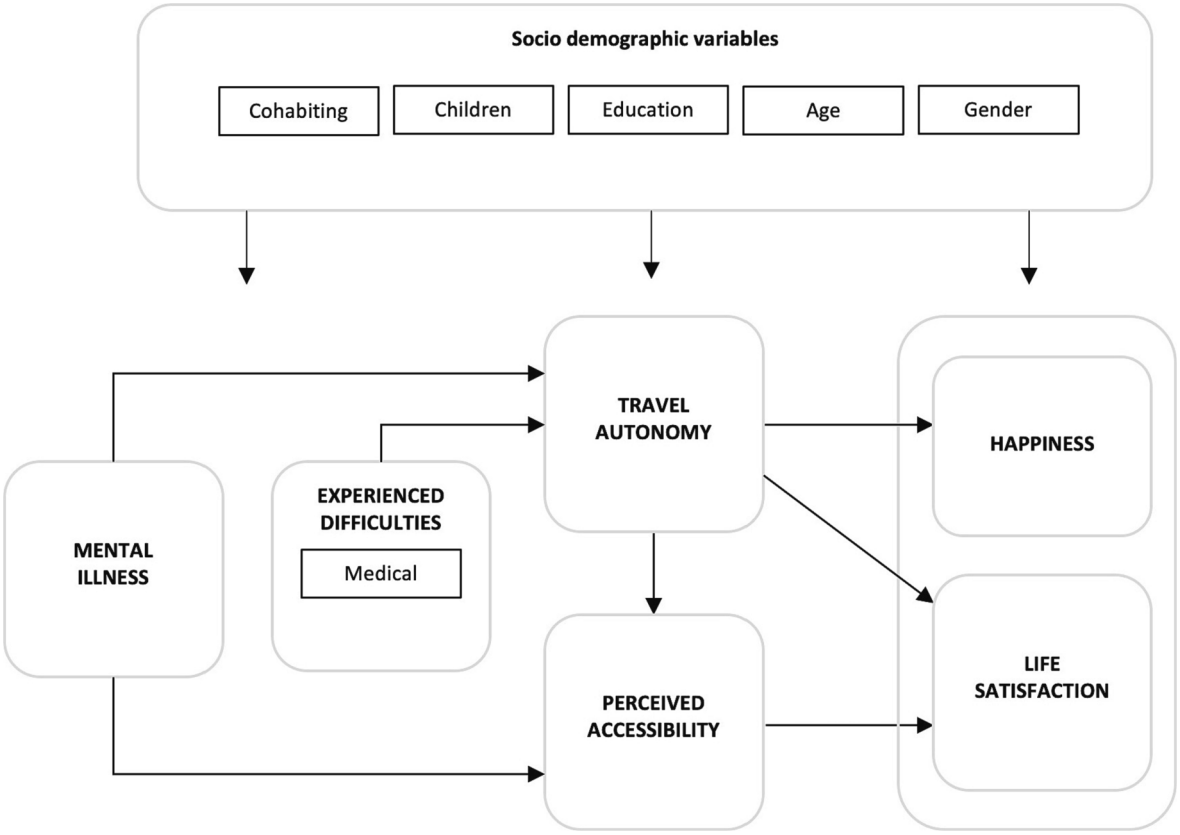

Fig. 2. Empirical results on significant relationships between mental illness, experienced difficulties, travel autonomy, perceived accessibility, happiness, and life satisfaction.

The strongest effect was observed in the path from travel autonomy to perceived accessibility, indicating that a stronger sense of travel autonomy is related to higher perceived accessibility. Furthermore, travel autonomy was directly and positively related to both happiness and life satisfaction. Notice that travel autonomy was not only directly related to happiness and life satisfaction. Significant indirect paths were also observed through perceived accessibility (for happiness: $\beta = 0.07$; for life satisfaction: $\beta = 0.08$). Hence, travel autonomy is the strongest contributor to the model.

The proposed paths of the conceptual model were only partially confirmed for perceived accessibility. The path from accessibility to life satisfaction was supported; meanwhile, the path to happiness, although significant, had a very small effect.

Among control variables, having children was the only significant variable for travel autonomy. The negative sign of the path coefficient yielding that having children living at home reduced travel autonomy. No sociodemographic variables were important for perceived accessibility. Cohabitation was positive for both happiness and life satisfaction. None of the other variables showed significant paths. Notably, medical and physical difficulties experienced increased with age (as expected), but mental illness was lower with increased age. Fewer mental illnesses were also reported for those cohabiting, but more so for women. Finally, those with fewer years of university education reported greater experience of medical and cognitive difficulties.

As suggested by Hair et al. (2021), the minimum sample size for the observed results was determined using the inverse square root method. A conservative inverse square root threshold was chosen as the reference (the lower bound of the significant path coefficients). The lower bound of the significant direct path coefficients (-0.13; Mental Illness -> Perceived Accessibility) fell within the range 0.11–0.20. Based on this range, approximately 155 observations were required to achieve a significant effect at the 5% significance level (see Table 1.3 in Hair et al., 2021). For the indirect effects, the lower bound was 0.07 (Autonomy -> Happiness) and required a sample size of 619. Hence, the sample size obtained in our study was considered sufficient for testing the model and observed effects.

Finally, FIMIX analyses were conducted to identify potential segments of the data, such as whether cities differ with respect to the outlined model. The results show that no identified segments provide better explanatory power for the data. Because the FIMIX did not yield potential segmentation, no follow-up multigroup analyses (PLS-MGA) were performed.

5. Discussion

The number of people experiencing various physical and mental difficulties is expected to increase over time. In this context, we

Table 3
Detailed results for the partial least square structural equation model.

PRIMARY VARIABLES	β	f^2	t	p	CI [2.5-97.5%]	
Autonomy -> Perceived Accessibility	**0.55**	**0.39**	**19.62**	**<0.001**	**0.49**	**0.60**
Autonomy -> Life Satisfaction	**0.28**	**0.06**	**7.31**	**<0.001**	**0.21**	**0.36**
Mental Illness -> Travel Autonomy	**-0.26**	**0.06**	**7.55**	**<0.001**	**-0.32**	**-0.19**
Autonomy -> Happiness	**0.26**	**0.05**	**6.93**	**<0.001**	**0.18**	**0.33**
Medical Difficulty -> Travel Autonomy	**-0.15**	**0.02**	**3.86**	**<0.001**	**-0.23**	**-0.08**
Perceived Accessibility -> Life Satisfaction	**0.14**	**0.02**	**3.54**	**<0.001**	**0.06**	**0.22**
Mental Illness -> Perceived Accessibility	**-0.13**	**0.02**	**4.53**	**<0.001**	**-0.19**	**-0.08**
Perceived Accessibility -> Happiness	0.12	0.01	3.13	0.002	0.04	0.19
Physical Difficulty -> Travel Autonomy	-0.11	0.01	2.86	0.004	-0.20	-0.04
Cognitive Difficulty -> Travel Autonomy	-0.07	0.01	1.73	0.084	-0.14	0.01
Physical Difficulty -> Perceived Accessibility	-0.05	0.00	1.49	0.136	-0.12	0.02
Medical Difficulty -> Perceived Accessibility	0.03	0.00	0.79	0.430	-0.04	0.10
Cognitive Difficulty -> Perceived Accessibility	0.02	0.00	0.50	0.620	-0.05	0.08
CONTROL VARIABLES						
Age						
Age -> Mental Illness	**-0.28**	**0.09**	**10.22**	**<0.001**	**-0.33**	**-0.23**
Age -> Physical Difficulty	**0.28**	**0.08**	**9.36**	**<0.001**	**0.22**	**0.34**
Age -> Medical Difficulty	**0.23**	**0.05**	**7.61**	**<0.001**	**0.17**	**0.28**
Age -> Cognitive Difficulty	-0.12	0.01	3.91	<0.001	-0.18	-0.06
Age -> Travel Autonomy	0.10	0.01	3.09	0.002	0.04	0.16
Age -> Life Satisfaction	0.07	0.01	2.50	0.012	0.02	0.12
Age -> Happiness	0.04	0.00	1.39	0.166	-0.02	0.09
Age -> Perceived Accessibility	0.03	0.00	1.05	0.293	-0.03	0.09
Children						
Children -> Travel Autonomy	**-0.13**	**0.02**	**4.19**	**<0.001**	**-0.18**	**-0.07**
Children -> Happiness	0.07	0.01	2.27	0.023	0.01	0.12
Children -> Cognitive Difficulty	0.05	0.00	1.57	0.118	-0.01	0.12
Children -> Mental Illness	-0.04	0.00	1.51	0.131	-0.09	0.01
Children -> Physical Difficulty	0.04	0.00	1.35	0.178	-0.02	0.10
Children -> Medical Difficulty	0.03	0.00	0.99	0.320	-0.03	0.09
Children -> Perceived Accessibility	0.01	0.00	0.53	0.600	-0.04	0.06
Children -> Life Satisfaction	0.01	0.00	0.40	0.687	-0.05	0.08
Cohabiting						
Cohabiting -> Happiness	**0.21**	**0.05**	**7.49**	**<0.001**	**0.16**	**0.27**
Cohabiting -> Life Satisfaction	**0.19**	**0.04**	**6.52**	**<0.001**	**0.13**	**0.24**
Cohabiting -> Mental Illness	**-0.16**	**0.03**	**5.33**	**<0.001**	**-0.22**	**-0.10**
Cohabiting -> Cognitive Difficulty	-0.10	0.01	3.13	0.002	-0.16	-0.04
Cohabiting -> Medical Difficulty	-0.07	0.01	2.18	0.029	-0.13	-0.01
Cohabiting -> Perceived Accessibility	0.05	0.00	1.97	0.049	-0.00	0.10
Cohabiting -> Physical Difficulty	-0.05	0.00	1.53	0.127	-0.10	0.02
Cohabiting -> Travel Autonomy	0.03	0.00	0.96	0.335	-0.03	0.08
Sex (women as reference)						
Sex -> Mental Illness	**0.14**	**0.02**	**4.86**	**<0.001**	**0.08**	**0.20**
Sex -> Travel Autonomy	0.02	0.00	0.81	0.416	-0.03	0.08
Sex -> Cognitive Difficulty	0.11	0.01	3.86	<0.001	0.06	0.17
Sex -> Medical Difficulty	0.07	0.01	2.51	0.012	0.02	0.13
Sex -> Perceived Accessibility	0.06	0.01	2.42	0.015	0.01	0.11
Sex -> Physical Difficulty	0.06	0.00	1.94	0.053	-0.00	0.12
Sex -> Happiness	-0.02	0.00	0.57	0.570	-0.07	0.04
Sex -> Life Satisfaction	-0.01	0.00	0.20	0.843	-0.06	0.05
University						
University -> Medical Difficulty	**-0.15**	**0.02**	**4.96**	**<0.001**	**-0.21**	**-0.09**
University -> Cognitive Difficulty	**-0.15**	**0.02**	**4.74**	**<0.001**	**-0.21**	**-0.09**
University -> Physical Difficulty	-0.11	0.01	3.51	<0.001	-0.17	-0.05
University -> Mental Illness	-0.04	0.00	1.45	0.146	-0.10	0.01
University -> Happiness	0.03	0.00	1.02	0.309	-0.03	0.09
University -> Life Satisfaction	0.03	0.00	0.91	0.366	-0.03	0.08
University -> Perceived Accessibility	-0.01	0.00	0.29	0.774	-0.06	0.04
University -> Travel Autonomy	0.01	0.00	0.17	0.866	-0.05	0.06

Note: β = Standardised Path Coefficient Estimates. F^2 = Effect Sizes (considered small above 0.02, medium above 0.15, and large above 0.35; bold numbers indicate at least a small effect size, also displayed as significant paths in Fig. 2.). CI = 95% Confidence Intervals (bias corrected).

consider the expected consequences for the transport system, such as less inclusiveness, if the gap between people with and without difficulties is allowed to increase. Specifically, considering the current transport system, we ask whether people can live the life they want while experiencing cognitive, medical, physical, or mental difficulties. Crucially, we develop a framework departing from travel

autonomy and perceived accessibility, and their relationship with well-being.

Our empirical analysis based on data from a Swedish survey supports the conceptual framework. Specifically, capabilities, independent travel, freedom, and possibilities are important in the overall concept of travel autonomy. Importantly, although related, the latent constructs in the model were discriminant from each other and should be treated as distinct constructs. Travel autonomy was associated with perceived accessibility, happiness, and life satisfaction. Thus, to develop an inclusive system, we need to focus on and prioritise interventions that support individual travel autonomy. However, our study does not provide answers as to what type of intervention, for whom, and under what conditions. We recommend that further research should be conducted in these areas. Furthermore, future intervention studies can use the transport autonomy scale presented in this study.

A general and important finding is that mental illness plays a vital role in daily travel. People with mental illnesses experience a lower degree of travel autonomy and perceived accessibility. This is consistent with earlier findings that mental health problems are related to experienced barriers, such as scheduling, waiting times, and staff attitudes (Bezyak et al., 2017). It is more difficult to live one's desired life with mental illness because of the perceived limitations in freedom and opportunities to travel. Still, we need to further understand which types of measures should be developed for this group so that they experience a higher degree of travel autonomy and perceived accessibility. Indeed, this sometimes forgotten group needs attention in our efforts to increase inclusion and should be prioritised. We acknowledge that the measure chosen to assess mental illness (MIH-5) does not capture all forms of mental illness, but should be viewed as an overall measure of mental illness capturing mood and anxiety (Rumpf et al., 2001).

Several studies have researched travellers experiencing physical and cognitive difficulties. Our empirical evidence reveals that people who reported cognitive and physical difficulties seem to do quite well in the transport system. Specifically, they experience travel autonomy and perceived accessibility to desired everyday activities similar to those with fewer or no difficulties. This may be because those with difficulties may have adapted to the system to some extent; moreover, the system also seems to give them the freedom to master their situation. However, notice that those who participated in our study did not experience extreme difficulties but were on the lower part of the seven-point scale. Therefore, we cannot draw any conclusions regarding how people with greater difficulties cope with transport systems. As such, a study of a group experiencing more severe difficulties could provide additional knowledge. A closer look at our empirical material showed that medical difficulties were more strongly related to travel autonomy than were cognitive and physical difficulties. One interpretation can be that while progress has been made to meet the needs of those with physical and cognitive difficulties, much work remains to understand and meet the needs of those with mental illness and medical difficulties. Our data cannot provide answers for the way forward to accomplish this; nevertheless, we hope that future studies will provide insights into how to best facilitate these individuals and their needs.

As expected, differences were observed in sociodemographic variables. Consistent with previous research, women and younger people generally reported greater mental illness, which was negatively related to travel autonomy and perceived accessibility. Developing actions, assistance, and interventions to accommodate the needs of those with mental illness may be especially beneficial for women and the young at an aggregate level.

As for all cross-sectional empirical data, although we may provide informed interpretations of the path dependencies of our model and the proposed framework, we cannot provide conclusive answers regarding causality. Future research should consider using controlled trials to assess causality. However, as our primary variables were mental illness and difficulties, designing such studies would be problematic, as we can never purposely create situations with, for instance, low travel autonomy that may lead to illness, reduced life satisfaction, or less happy people. The only viable solution is to use longitudinal panel data studies in which individuals are followed over a longer time, measuring mental illness, various difficulties, autonomy, and well-being, and examining how these are related and vary over time. We hope to see such studies on this topic. Another relevant endeavour can be to empirically test models with alternative paths, such as potential reverse effects where travel autonomy and perceived accessibility influence mental illness, or where perceived accessibility precedes travel autonomy.

We developed and used a scale to measure travel autonomy. The scale, consisting of four items covering capabilities, independent travel, freedom, and possibilities, was valid and reliable, and distinct from other constructs, such as perceived accessibility. The four scale items represent different aspects of travel autonomy but were found to be highly related, with a CR of 0.90, thus acting as building blocks for the latent construct of travel autonomy. We believe that this latent construct is an important mechanism to consider when assessing transport systems, as it complements other subjective and calculated measures of accessibility. We showed that our brief travel autonomy scale is a valid and reliable measure for capturing the latent construct; this scale may be easily administered in future surveys. For more nuanced findings on each of the four aspects of travel autonomy, items can be added to each aspect. Next, we need to identify factors beyond those considered here that can explain the degree of travel autonomy. Researchers can look at both subjective and objective variables, such as issues related to attitudes and norms, or travel prerequisites, such as infrastructure or urban form. Once we have a more nuanced picture, actions and support mechanisms can be developed more easily by targeting different segments of the population.

6. Conclusion

Considering the findings and limitations presented above, does the proposed framework capture the necessary components to extend our knowledge about informed decisions regarding the development of an inclusive transport system? Or, are we leaving some people behind? Our point of departure to examine this is an individual's well-being. The framework and our empirical data show that travel autonomy and perceived accessibility are two crucial components of well-being, dependent on both medical and mental difficulties. This is an important insight for the continued development of the transport system. Efforts should prioritise finding support mechanisms and implement interventions that increase the degree of travel autonomy and perceived accessibility for those with

disabilities. Scrutinising our proposed framework with new empirical data in new contexts can help in further developing and refining it. This may help us develop a more nuanced picture of the proposed paths. We are confident that travel autonomy and perceived accessibility are two mechanisms of great importance that require attention in future research and practice.

7. Declarations

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The datasets generated and analysed in the current study are not publicly available owing to restrictions imposed by ethical regulations, as they include personal information on physical and mental health. The decoded data are available from the corresponding author upon request.

CRediT authorship contribution statement

Margareta Friman: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **Lars E. Olsson:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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