

# Una revisión sistemática sobre cómo afecta la movilidad urbana y la accesibilidad a la calidad de vida

A Systematic Review on How Does Urban Mobility and Accessibility Affect Quality of Life

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**Hamza Yasin**<sup>✉</sup>

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Tutor: Inmaculada Mohino, José Carpio-Pinedo

## Resumen:

*Una vida mejor es el objetivo de cualquier individuo y el transporte juega un papel evidente en la mejora de la calidad de vida. Anteriormente, la movilidad del transporte se ha explorado en relación con la calidad de vida, pero los resultados siguen sin ser concluyentes y las medidas de accesibilidad al transporte aún no se han examinado con respecto a la calidad de vida. Por lo tanto, revisamos científicamente 39 publicaciones en inglés hasta el 10 de agosto de 2022 a las que se accedió desde siete bases de datos diferentes y sintetizamos los resultados utilizando las directrices PRISMA. Se encontró que el tiempo de viaje, el modo de viaje y la distancia de viaje son los atributos de movilidad de transporte más significativos asociados con las medidas afectivas y cognitivas de la calidad de vida. La accesibilidad percibida, el acceso al transporte público, el acceso a diferentes modos de transporte y el acceso a las paradas de autobús se encontraron como atributos de accesibilidad al transporte que afectan significativamente la calidad de vida. Sin embargo, la interacción entre el transporte y la calidad de vida sigue sin ser concluyente.*

## Palabras clave

*Accesibilidad, bienestar subjetivo, calidad de vida, movilidad urbana, transporte*

## Abstract:

*A better life is the goal for any individual and transport plays an evident role in improving the quality of life. Previously transport mobility has been explored in relation to quality of life but results remain inconclusive and transport accessibility measures are yet to be reviewed in respect to quality of life. Therefore, we scientifically reviewed 39 English language publications up to 10th August 2022 accessed from seven different databases and synthesized the results using PRISMA guidelines. Travel time, travel mode and travel distance were found to be the most significant transport mobility attributes associated with affective and cognitive measures of quality-of-life. Perceived accessibility, access to public transit, access to different modes of transportation and access to bus stops were found as transport accessibility attributes significantly affecting quality of life. The interaction between transport and quality of life, however, remains inconclusive.*

## Keywords

*Accessibility, quality of life, subjective wellbeing, transport, urban mobility*

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✉ **Hamza Yasin** es Doctorando en Sostenibilidad y Regeneración Urbana del Departamento de Urbanística y Ordenación del Territorio - Escuela Superior de Arquitectura de la Universidad Politécnica de Madrid.

m.hamzayasin@gmail.com

ORCID: <https://orcid.org/0000-0003-2139-489X> (Hamza Yasin)

## 1 Introduction

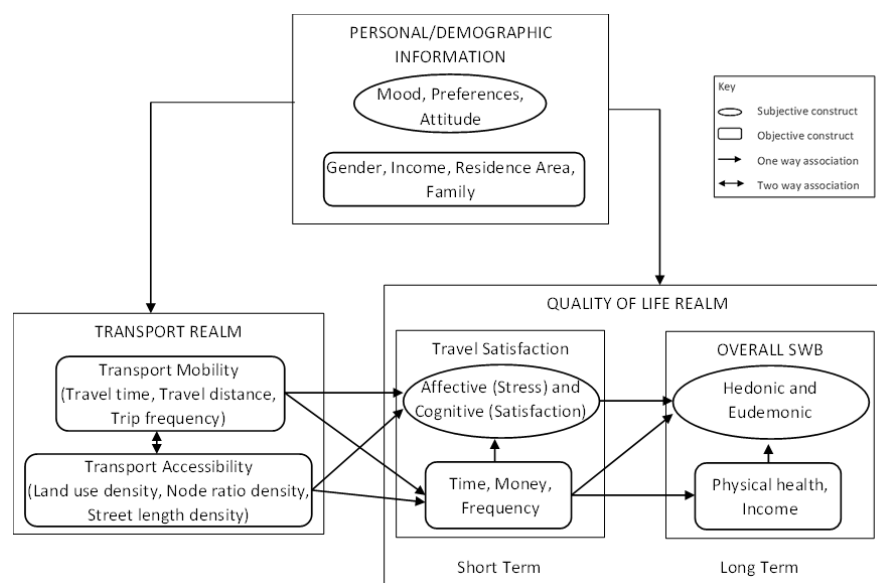
Better life is the universal goal around the world, and past decade has seen growing interest in studying the associations between quality of life and urban transportation (Chatterjee et al., 2020). Increased traffic volumes in many countries have exacerbated the conditions of air pollution, traffic congestion and health problems (Ettema et al., 2015). Resultantly, this negatively affected the quality of life. Growing literature has shown a significant association between transportation and quality of life using different terminologies i.e., effects of urban mobility, accessibility, daily travel and commuting preferences on happiness (Ettema et al., 2013), life satisfaction (Ingenfeld et al., 2019), subjective well-being (Ravulaparthi et al., 2013), physical and psychological health and well-being (Mattisson et al., 2018), and livability, etc. The multi-dimensionality of quality of life makes it very difficult to completely measure it. Therefore, most studies use aggregated methodologies for measuring quality of life still end up leaving some part either objective or subjective out of the model (J. Kim et al., 2020) and consequently create plethora of terminologies measuring almost the same thing. However, trends in daily travel indicate that travel time is increasing. The Mobility Survey 2020 by Euromonitor International shows that 50% of global respondents commute five or more days per week, while 63% spend on average 15 to 60 minutes travelling (Liuima, 2021). Historical commuting trends also demonstrate a steady increase in travel time over the years (Giménez-Nadal et al., 2022). Research aligns longer commuting time and distance with adverse effect on mood (Ettema et al., 2011), mental stress (Mattisson et al., 2018), subjective wellbeing and quality of life (Liu et al., 2022). Mode choice and accessibility also have significant association with subject wellbeing and quality of life (J. Kim et al., 2020; Spinney et al., 2009; Bergstad et al., 2011; Eriksson et al., 2013; Ingenfeld et al., 2019; Vella-Brodrick & Stanley, 2013). Ease of access to active modes, public transport, and opportunities for social interaction has been reported to enhance mental and physical health, subjective well-being, and overall quality of life (Vella-Brodrick & Stanley, 2013). Satisfaction with travel also contributes to long-lasting positive effects on subjective well-being and quality of life (Ettema et al., 2011). Users of active modes of transport are generally more satisfied with their trips than those using private modes (Friman et al., 2017).

Policymakers have suggested a behavioral shift from passive modes of transport to active modes and public transport (Bamberg, 2014; Brög et al., 2009; Richter et al., 2011). To sustain this behavioral shift, it is needed to study the relationship between transport mobility, travel satisfaction and quality of life for different modes of transport. Many previous studies have examined this relationship, but the results remain inconclusive (Chatterjee et al., 2020). Contrary to some earlier findings, longer commuting distances and times have been found to positively affect quality of life (J. Kim et al., 2020). Additionally, a non-linear relationship between commuting and life satisfaction suggests that negative effects of longer travel distances are observed primarily for trips exceeding 50 miles (Ingenfeld et al., 2019). Similarly, previously it was found that increased mobility and accessibility will increase travel and ability to initiate and maintain social interactions which would lead to better quality of life (Ling & Mannion, 1995; Webster et al., 2002). but later on, it was found that increased mobility and accessibility can reduce the quality of life as the increase travel would mean more motor vehicles, pollution and stress in city life (Hart, 2008).

In accordance with the contradictory evidence found on the relationship between commuting and quality of life, there is a need to synthesize the all the information into a review paper. Although, there has been previous attempts to synthesize the evidence (Chatterjee et al., 2020; De Vos et al., 2013; Delbosc, 2012; Liu et al., 2022; Nordbakke & Schwanen, 2014; Norgate et al., 2019; Reardon & Abdallah, 2013), but most of them are limited in scope. Delbosc (2012), for instance, primarily relied on studies using self-reported well-being scales, while De Vos et al. (2013) solely covered the transport relationship with the subjective wellbeing. Nordbakke & Schwanen, (2014) focused on the older age population and the working/studying population was not included, whereas Norgate et al. (2019) restricted the population to working class and studied only public transport in relation to health impacts. Moreover, Chatterjee et al.

(2020), Liu et al. (2022) and Reardon & Abdallah (2013) also made attempts to comprise literature but the studies relating accessibility and well-being were not covered. Therefore, to address these gaps in previous studies, a holistic attempt will be made to cover empirical studies on the correlations between mobility, accessibility, travel satisfaction and quality of life.

The complex nature of relationship between transport realm and quality of life realm can be simplified from our conceptualization (figure 1), which is partly derived from conceptual model of (Ettema et al., 2010) on the relationship between travel and wellbeing. However, our model takes account of the dimensions of transport accessibility as well. The paper starts with (section 2) defining the criteria for literature review. Then, it builds up on findings (section 3) by taking studies into consideration for defining the characteristics of transport mobility (section 3.1) and transport accessibility (section 3.2). Measures of travel satisfaction (section 3.3) and quality of life (section 3.4) are explored through several studies along with their associations with the transport realm (section 3.5). Finally, the paper concludes with discussion on future research possibilities (section 4).



**Figure 1:** Conceptual model for relationship between quality of life and transport

## 2 Methods

Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines were used for this paper. The review focused on identifying published empirical studies that explored the association between transport mobility (including public transport), travel satisfaction, and quality of life (i.e., subjective wellbeing, life satisfaction, and happiness). The literature search was conducted using the database sources, namely Scopus, Web of Science, IngentaConnect, Social Sciences Citation Index, Transport Research International Documentation (TRID), Google Scholar and ProQuest Central. The relevant studies published before 10 August 2022 were identified for this review. Three key concepts guided the study: transport mobility, travel satisfaction, and quality of life. Search terms related to these concepts were drawn from previous empirical studies and reviews. Terms associated with transport mobility included commuting, daily travel, work-related travel, and mobility. Travel satisfaction-related terms included commute satisfaction, satisfaction with travel, and work travel satisfaction. Quality of life-related terms included well-being, subjective well-being, life satisfaction, welfare, life happiness, and physical or mental health.

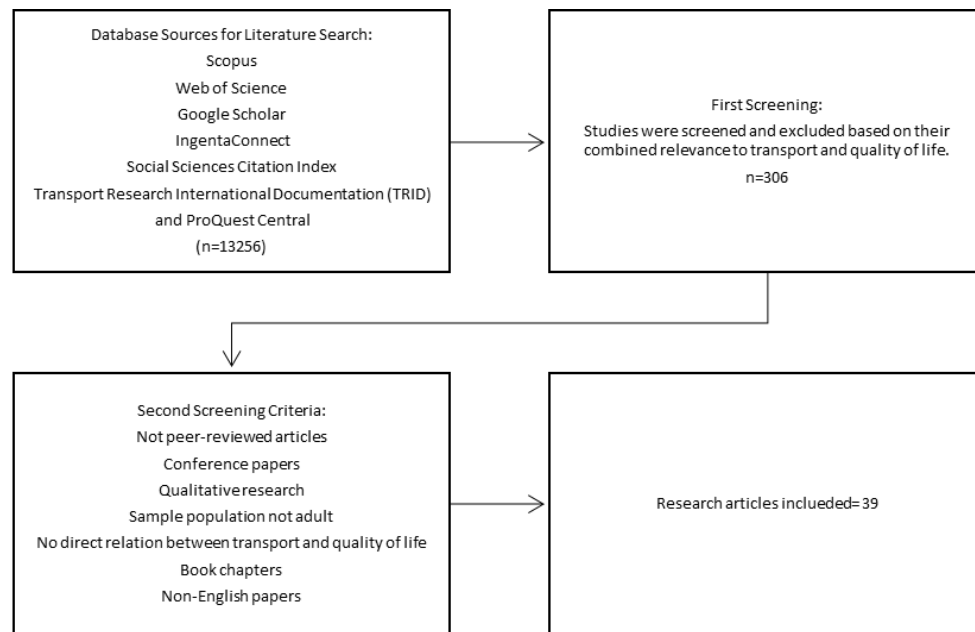


Figure 2: PRISMA diagram for study selection

As shown in Figure 2, an initial total of 13,256 studies were identified based on the selected keywords. This high number resulted from the multidisciplinary nature of quality of life and the frequent recurrence of related terms such as happiness, well-being, and satisfaction. During the first screening, studies were reviewed for their combined relevance to transport, accessibility, and quality of life, resulting in 306 potentially relevant studies. A second screening applied predefined inclusion criteria: studies written in English, based on quantitative empirical data, involving travel for work or study, published as full-length peer-reviewed papers, and reporting outcomes related to quality of life, subjective well-being, life satisfaction, happiness, or travel satisfaction. Studies were excluded if they were conference papers, book chapters, reports, qualitative in nature, experimental or laboratory-based, focused on non-work or non-study travel, or included participants under 18 years of age. After applying these criteria, 39 studies were included for full-text review.

### 3 Findings

Data extraction was performed consistently across all eligible studies. The summary of studies shown in Table 1 included titles, authors, publication year, study location, variables, research methods, and key outcomes.

Table 1: Summary of studies

Papers	Location	Variables	Research Method	Key Outcomes
(Vella-Brodric & Stanley, 2013)	Melbourne, Australia	Travel behavior, Psychological Well-being, Subjective Well-being	Hierarchical regression analysis, Mediation of PWB in the relation of Mobility and SWB	Mobility was no longer a significant predictor of SWB while controlling the variance in Psychological Well-being
(Spinney et al., 2009)	Canada	Mobility characteristics and Quality of life	Correlational technique	Not significant association b/w satisfaction with life as a whole and transport mobility benefits, but relation was seen with other indicators of QOL

Papers	Location	Variables	Research Method	Key Outcomes
(Hybel & Mulalic, 2022)	Denmark	Transportation and Quality of life index	Multivariate Regression	Proximity to highways and the provision and quality of public transport is positively related to the quality-of-life indices
(S. Kim & Ulfarsson, 2013)	America	Relationship b/w QLI and personal, household and transportation characteristics	Linear Regression Analysis/ Explanatory factor analysis	Lack of commuting and inability to drive was significantly and negatively associated with QLI Availability of transit services within walking distance is not significantly related with QOL Information and Availability of transportation alternatives is positively associated with QOL Walking access and alternate transport option is of great importance for those who don't drive
(Chng et al., 2016)	London UK	Travel mode and public transport connectivity's association with SWB	Multivariate linear regression Analysis	Only walking commutes were significantly related to higher level of life satisfaction Public transport connectivity was significantly associated with lower mental stress
(Dorantes Argandar et al., 2016)	Cuernavaca, Mexico	Stress situations and traffic situations	Factor Analysis	One will be stressed by traffic situation regardless of age and gender
(Mattison et al., 2018)	Scania, Sweden	Health indicator and commuting mode choices	Discrete Multinomial Logit Models	Health indicators such as difficulty in walking and obesity was negatively related to use of active transport and public transport Weaker links were found b/w mental health indicators and mode choice, but mental stress nevertheless had negative link to the use of active transport
(Ettema et al., 2011)	Sweden	Travel satisfaction, Mood Satisfaction, Subjective well-being	Correlation and factorial analysis	STS is reported higher for the car users as compared to bus users. STS increases with access to bus stops and decreases with travel time
(Taniguchi et al., 2014)	Värmland, Sweden	Travel satisfaction, Goal Achievement, Public Transport Usage	Correlational Analysis	Distance from home to bus stop was negatively related to STS Satisfaction with travel had significant positive effect on the PT use STS has positive effect on likelihood of PT use for future
(Eriksson et al., 2013)	Sweden	Travel satisfaction, Travel Mode Choice, Mood	Correlational, regression and Factorial Analysis	Satisfaction with travel by car was higher than the bus. Partially STS mediated the effect of travel mode on SCAS. However, STS was not affected by travel mode when the SCAS was constant.
(Ettema et al., 2013)	Netherlands	Trip characteristics, Personal Characteristics, Road Conditions, STS	Regression analysis	Crowdedness has negative effect on the STS Temporary lanes and signs also have negative effect on STS Travel purpose is significantly related to STS i.e. recreational trips were found to be more satisfactory

Papers	Location	Variables	Research Method	Key Outcomes
(Delmelle et al., 2013)	Vienna, Austria	Social Satisfaction, Personal Characteristics, commuting and transportation variables, housing and residential neighborhood characteristic	Regression analysis	Living in the proximity of a transit stop has significant positive impact on social satisfaction longer commuting durations have significant negative impact on the social satisfaction car ownership is associated positively with the social satisfaction
(Susilo & Cats, 2014)	8 Cities from	Trip-attributes and real time travel related variables and attitudes, trip complexity, subjective well-being indices, and overall satisfaction	Multivariate Statistical Analysis	Past experiences, traveler's mood, attitudes, expectations, and emotional state were significant explanatory indicators. Perceived travel time, distance and road safety was significant in deciding the travel satisfaction Personal and trip related attributes were insignificant to travel satisfaction except for trips made for business.
(St-louis et al., 2014)	Montreal, Canada	Travel attributes, travel satisfaction and overall life satisfaction.	Correlational and regression analysis	Commuting in the snow makes trips less enjoyable for everyone. For six types of travel, longer travel times lead to lower satisfaction. Satisfaction for metro users and pedestrians differs by gender. Overall life satisfaction is important for pedestrians, cyclists, bus riders, and metro users.
(Sun et al., 2015)	China	wellbeing, travel characteristics, health indicators	Multivariate linear regression analysis	Active commuting to school is correlated to the better physical and mental wellbeing.
(Oliveira et al., 2015)	Brazil	Perceived health, socio-economic and demographic info, and commuting time.	Propensity score matching, Regression analysis	Persons with commuting time more than 1 hour had higher probabilities to report bad self-assessed health conditions in contrast to those who had commuting time less than 1 hour.
(Lorenz, 2018)	Germany	Cognitive and affective wellbeing, personal information, and commuting information.	Robustness checks, regression and mediation models	no evidence was found on the statement that travel distance is related to lower overall satisfaction of life However, it was seen that travel distance is related to lower levels of satisfaction in certain domains such as family life and leisure activities.
(Sha et al., 2019)	Hong Kong	Commuting time, commuting modes, and wellbeing	Multivariate logistic and linear regressions	Longer travel times are related to high risks of being obese and overall lower SWL as compared to people who travel within 30 min.
(Kent et al., 2019)	Oran park, Sydney, Australia	Physical, mental and subjective well being demographics, and travel behavior.	Factor Analysis, regression Analysis	Increase in commute time and commute time for departure has been associated with lower levels of SBW and mental health scores
(Rüger et al., 2017)	Germany	Stress and health related quality of life (HRQOL) and commuting behavior	Mediation Models, Regression Analysis	Longer commute times are associated with higher perceived levels of stress and lower HRQOL. Stress is seen as strong mediator in the relation b/w commuting time and HRQOL

Papers	Location	Variables	Research Method	Key Outcomes
(J. Kim et al., 2020)	Shizuoka city, Japan	Travel characteristics, travel satisfaction, and quality of life	Regression Models	Longer travel is associated with higher quality of life
(Olsson et al., 2020)	7 European Cities	STS, SWLS, personal characteristics, travel behavior, service quality of PT	Structural equation modelling and reliability tests ANOVA	Younger and older people were happier with travel than middle-aged people. However, younger and middle-aged people reported lower life satisfaction compared to others. Older people were generally more satisfied with life and travel. Using public transport is linked to lower satisfaction.
(Friman et al., 2017)	Sweden (Göteborg, Karlstad, and Stockholm)	Daily travel, life satisfaction, satisfaction with travel, emotional well being	PLS SEM, Structure Equation Modelling	EWB is directly associated to satisfaction and satisfaction with travel Life satisfaction is associated through EWB with travel satisfaction. Age is also directly associated with life satisfaction
(Vos et al., 2015)	Ghent Belgium	Satisfaction with travel, socio-demographics, and travel characteristics	Correlations,	Specification of single section on affective measure is more suitable for Ghent data for all modes Future research may want to modify STS or use alternatives for the items
(Morris, 2015)	America	Life satisfaction, socio-demographics, travel characteristics	Correlations and regression	Travel time each day is linked to how happy people feel. In small towns and cities, travel time is closely connected to happiness. Time spent on activities outside the home is also related to feeling satisfied with life. Additionally, walking and biking for fun and relaxation are strongly connected to happiness.
(Lättman et al., 2019)	5 cities of Northern Europe	Socio-demographics, commuting attributes, STS, SWL, perceived accessibility	Partial least square Structure equation modelling	Perceived accessibility was found related to STS and SWL. STS was directly associated with SWL Age played a moderating effect in the relationship b/w perceived accessibility and SWL and STS
(Pan et al., 2020)	Shanghai, China	Travel motivation, travel constraints, travel satisfaction, leisure life satisfaction, LS	Factor Analysis and correlations	Travel constraints do not affect the travel satisfaction. Travel motivation impact travel satisfaction ILS and LS Constraints negatively influence LS
(Mccart hy & Ahsanul , 2018)	Nova Scotia, Canada	Travel behavior, subjective wellbeing attitudes towards transportation, built environment	Factor Analysis and regression	Time spent on daily out of home activities positively correlates with cognitive wellbeing by facilitating access to different activities People living in proximity to parks were more satisfied with life Higher access to various travel modes relates positively with life satisfaction
(Ye & Titheridge, 2019)	Xi'an, China	Travel characteristics, satisfaction with travel and life	Factor Analysis and Regression analysis	Lower income strata will choose public transport or active modes of transport as the primary mode of choice, but bus was correlated with lowest satisfaction with life Travel time and congestion were two significant indicators of travel satisfaction,

Papers	Location	Variables	Research Method	Key Outcomes
(Kroese et al., 2014)	Netherlands	Demographics, body mass index, health perception, travel time, job satisfaction, commuting methods, car ownership, social interaction satisfaction, and overall wellbeing.	Structure Equation Modelling	Travel time usually decreases happiness, except for biking. More travel time is linked to higher education and income. For car users, urban density increases travel time, but for bikers, it decreases. Most correlations between travel time and other factors are strong, except for BMI. There is no link between travel time and perceived health or job satisfaction.
(Singleton, 2019)	Portland, Oregon USA	Socio-demographics, Travel Characteristics, STS	Factor Analysis	3 factor structure model of STS 2 affective and 1 cognitive fit the data STS exhibited weak invariance across several modes non-motorized trips tended to have more positive scores for STS
(Nie & Sousa-poza, 2018)	China	SWB, perceived travel time, time for Daily Activities. travel mode, personal and household characteristics	Multiple mediation Analysis	Travel time is significantly related to decreasing SWB when happiness and life satisfaction is used as proxy No significant association was found b/w active commuting and SWB whether life satisfaction or happiness is used as proxy Model b/w CT and SWB was not mediated by 5 time use activity variables

### 3.1 Overview of mobility characteristics

Mobility is defined as the “need and ability to move,” and it is frequently measured through the number of trips, the time spent on different out-of-home activities, travel time, and travel distances (J. Kim et al., 2020). Literature studies the relationship between mobility and well-being by different names and measures of mobility i.e., commuting, daily travel, active travel, public transport travel, etc. Commuting and daily travel refers to “trip made from home to work/study” (Giménez-Nadal et al., 2022) and trip refers to both one way and two-way movement between origin and destination in different studies. Travel time/distance, travel mode and trip frequency remain the most significant indicators. Travel time and distance are measured both subjectively via individual’s self-report or travel diary (Nie & Sousa-poza, 2018) and objectively via GIS and Network Analysis based techniques (Ye & Titheridge, 2019). Kim et al. (2020) assessed the objectively measured commute time and distance record from public transport card data in Japan. Time use on different out of home activities was also used in some studies to portray mobility characteristics (Adam et al., 2018; Morris, 2015; Nie & Sousa-poza, 2018; Spinney et al., 2009). But predominantly, literature studies mobility/commuting characteristics through travel time/distance measured by the individual’s self-response on questionnaire.

### 3.2 Overview of accessibility characteristics

Literature describe accessibility as “access to out of home activities” (Lättman et al., 2019) and it is mostly measured by population density, compactness, land use distribution, walkable distances, etc. A very limited literature is available studying the association between transport accessibility and quality of life. Accessibility is a pertinent subject as access to out of home activities boost the social interactions that are necessary to attain a good life satisfaction level. Accessibility is also measured both ways; perceived accessibility via perceptions of people regarding the ease of access to different opportunities and objective accessibility where proximity to different activities and density of those activities is measured. Perceived accessibility is the most frequently used measure in the limited share of literature where perceived

accessibility scale (PAC) (Lättman et al., 2016, 2019) consisting of 4 statements was used in the form of questionnaire to seek perceptions of people in terms of ratings on 7-point Likert scale (1=strongly agree to 7= strongly disagree). The four statements about daily travel included, 'it is easy to do daily activities', 'I can live my life as I want', 'I can do all the activities I prefer to' and 'access to my preferred activities is satisfying'. Objective measures of accessibility include land use proximity and density-based indicators (Delmelle et al., 2013; McCarthy & Ahsanul, 2018; Ye & Titheridge, 2019). Some of these indicators include, '% of commercial land use around home/job', '% of bus/rail stations around home/job', 'distance from CBD and open spaces', 'node ratio around home/job', 'street length density', 'construction density' and 'population density'. GIS is most frequently used to measure these indicators. Some researchers have found public transport accessibility level (PTAL) (Inturri et al., 2021; Ye & Titheridge, 2019) developed by Transport of London as a suitable measure for public transport accessibility where there are 6 levels from 1 (low or very poor accessibility) to 6 (high or excellent accessibility). PTAL is a very good, comprehensive and objective measure to assess the service coverage and accessibility of public transport. PTAL calculates trip time and average accessibility by considering, "walking time to service access points", 'scheduled waiting time', 'average waiting time', 'total access time' and 'equivalent doorstep frequency'.

### 3.3 Measures of travel satisfaction

Travel satisfaction is taken by transport researcher as the affective and cognitive evaluation of trips (Ettema et al., 2011). Larger part of the empirical studies conducts this evaluation retrospectively through a questionnaire and mostly rely on respondents' memory of the trip (Lättman et al., 2019; Singleton, 2019) but limited studies conducting travel satisfaction on site or during travel have reported considerable differences in the satisfaction levels (Ettema et al., 2013; Susilo & Cats, 2014). Travel satisfaction depends on multiple factors, including mood, travel conditions, and mode of transport, with users of active modes consistently reporting higher satisfaction over the years (Bergstad et al., 2011; Lättman et al., 2019; Majumdar et al., 2021). However, most studies have measured travel satisfaction through Satisfaction with Travel Scale (STS). Satisfaction with travel scale is derived from the measures of subject well-being and can be divided into two dimensions: affective and cognitive (Ettema et al., 2011). Affective evaluation of travel refers to the short-term individual's emotion state (i.e., duration, frequency and intensity of positive or negative affect) and it comprises 6 items divided in two parts: positive activation and positive deactivation. Whereas cognitive evaluation refers to overall impression of the trip (i.e., are you satisfied with your trip) and it comprises of 3 statements. Some studies have also used contextually designed questionnaire to seek the perceptions of the individuals regarding their travel (Inturri et al., 2021; J. Kim et al., 2020; Majumdar et al., 2021; St-louis et al., 2014; Ye & Titheridge, 2019). Self-designed questionnaire has also tried to measure the travel satisfaction onsite, and retrospectively (Inturri et al., 2021; Susilo & Cats, 2014), but largely Satisfaction with Travel Scale is seen in literature.

### 3.4 Measures of quality of life, subjective well-being and life satisfaction

Quality of life is a very complex and multidimensional concept (Diener & Suh, 1997; Hybel & Mulalic, 2022). It is a great challenge to completely measure quality of life as most of methods end up lacking its different dimensions (J. Kim et al., 2020). Therefore, the literature predominantly focuses on studying the association between quality of life and transport mobility rather than measuring the impact of transport mobility on quality of life (Chatterjee et al., 2020; Liu et al., 2022). In view of the complexity, quality of life is mostly represented in research through the measures of life satisfaction, happiness and well-being. Well-being is categorized as physical wellbeing, psychological wellbeing and social wellbeing. Whereas subjective well-being is self-ratings on short term (hedonistic or affective scale) and long term (eudemonics or cognitive scale) life benefits (Lorenz, 2018; Mokhtarian, 2019; Ravulaparthi et al., 2013). The physical and psychological health is measured through standardized scale of short form SF-12 (Kent et al., 2019). Scores are given to 12 items and T-scores are summoned to form 2 scale: Mental Component Summary (MCS-12) and Physical Component Summary (PCS-12). Physical health is also measured through self-rated health questionnaires where respondent is being asked on how one may feel about his/ her health (Oliveira

et al., 2015; Sha et al., 2019). Body Mass Index (BMI) is also seen as objective and predominant measure of physical health (Kroesen, 2014; Sha et al., 2019). Mental health is also measured by a British made 12 items General Health Questionnaire (GHQ-12) or 42 items scale of psychological wellbeing (SPWB) (Sha et al., 2019; Vella-Brodrick & Stanley, 2013). Quality of life, life satisfaction, happiness, cognitive subjective wellbeing, and overall wellbeing was measured in some studies through single item questionnaire i.e., how satisfied are you with your overall life? Affective or hedonic SWB is measured by Positive and Negative Affect Scale (PANAS) where respondents are questioned about how they felt during the last few days using 10 descriptors for presences of positive (proud) affects and absence of negative (ashamed) affects, and Swedish Core Affect Scale (SCAS), where respondents are asked how they felt about a particular moment on valence scale (i.e., sad, depressed, displeased and glad, happy, pleased) and activation scale (i.e., dull, passive, sleepy and pappy, active, awake). Whereas the most important ways of measuring the eudemonic aspect of well-being include: Personal Wellbeing Scale (PWS) (Ryff & Singer, 2008; Vella-Brodrick & Stanley, 2013) and the Questionnaire for Eudemonic Well-Being (QEWB) (Waterman et al., 2010). Both PWS and QEWB measure eudemonic well-being with six different dimensions. PWS assumes the dimensions of EWB to be self-acceptance, positive relationships, personal growth, purpose in life, and autonomy, whereas QEWB assumes the sense of meaning in life, self-discovery, perceived development of one's potential, the pursuit of knowledge, involvement in activities and enjoyment as the EWB's dimensions. Both ways of measuring EWB use a Likert-type scale against different indicating statements (i.e., strongly satisfied to strongly dissatisfied). Many researchers have used similar scales with personal modifications, but the overall quality of life is measured with the Satisfaction of Life Scale (SWLS) (Eriksson et al., 2013; Ettema et al., 2011; Pavot & Diener, 1993; Sha et al., 2019). The respondents are asked on the Likert scale how strongly they agree or disagree with five statements, i.e., I am satisfied with my life..

### 3.5 Associations of Quality of Life

Literature has shown quality of life or life satisfaction to be associated with various measures of transport mobility, but travel time and travel mode remain the most pertinent ones. Active modes of travel (walking or cycling) are associated significantly with greater life satisfaction as compared to passive modes (cars or buses) whereas, cars in comparison to buses are associated with higher life satisfaction (Eriksson et al., 2013). Increase in travel duration decreases the life satisfaction for many studies (Delmelle et al., 2013; Sha et al., 2019; Singleton, 2019; St-louis et al., 2014). However, Lorenz, 2018 and Morris & Zhou, 2018 have found that longer travel distance and travel time are not related with lower satisfaction with life. Meanwhile, (J. Kim et al., 2020) reported an increased travel time in fact is related with increased level of quality of life. The inconsistency can be explained by varying attitudes and research environments. However, travel satisfaction was reported to be higher where trip duration was short and not shaped by delays and congestion (Denstadli et al., 2017; Higgins et al., 2018; Singleton, 2019). People's attitudes also played a significant role in determining travel satisfaction; those who perceived their travel time as useful reported higher satisfaction (Denstadli et al., 2017). Active modes of travel also have highest travel satisfaction (Singleton, 2019), whereas cars were associated higher travel satisfaction in comparison to buses (Smith, 2017; Zhu & Fan, 2018). Other factors such as demographic information, weather condition, physical and emotional state, and riding with companion also effected the transport mobility and quality of life relationship (Friman et al., 2018; Higgins et al., 2018; Singleton, 2019; Smith, 2017; Zhu & Fan, 2018).

In respect to association between transport accessibility and quality of life, research has not been carried out adequately (Liu et al., 2022; Mao et al., 2022), however perceived accessibility has been associated with wellbeing and life satisfaction several times (Lättman et al., 2016, 2019). Perceived accessibility was reported to be positively affecting the travel satisfaction and satisfaction with life (Lättman et al., 2019). Travel satisfaction was also observed to increase with higher access to bus stops (Ettema et al., 2011) and higher access to different modes of transportation relates positively with life satisfaction (Mccarthy & Ahsanul, 2018). Wang et al., 2020 also found that travel satisfaction can be increased by providing higher access to facilities. Mao et al., 2022 observed that the supply of public transit i.e. access to public transit

has positive effect on travel satisfaction, but how they will interact with each is still unknown. Research on transport accessibility often goes hand in hand with built environment and neighborhood design i.e. high density and mixed land use development promotes active modes of transport (Brown et al., 2016; Wu et al., 2022). Mixed land use was seen contributing positively to life satisfaction (Wu et al., 2022) in comparison to land fragmentation which was found detrimental to achieving higher life satisfaction (Brown et al., 2016). Mixed land use was also observed to positively affect the active transport which increases travel satisfaction and ultimately life satisfaction (Brown et al., 2016).

## 4 Conclusion

This review paper is the first one to include transport mobility characteristics as well as transport accessibility characteristics in relation to the quality of life and our results were found to be congruent with previous studies. Transport mobility characteristics i.e., travel mode, travel time and travel distance were found significantly associated with measures of quality of life. Active modes of transport had the most positive effect on travel satisfaction and life satisfaction. Although consistent with previous studies, longer travel time negatively affected both travel satisfaction and life satisfaction but some positive and null associations were also found evident. It was also found that commuters were more satisfied with their lives and trips if they were able to travel longer distances. Our review paper found transport accessibility characteristics are also significantly associated with travel satisfaction and life satisfaction. Higher perceived accessibility was reported to result in higher travel satisfaction and life satisfaction. Access to bus stops and different modes of transportation positively affective and cognitive measures of quality of life. Better reach to public transit influences travel satisfaction and life satisfaction in a positive manner. Nevertheless, the association between transport accessibility and quality of life was found to be inadequately explored and more dedicated research is required to explore this topic. It is also necessary to revise how specific domains of transport and quality of life are measured. To obtain conclusive and comparable results, the metrics used for transport attributes and quality of life indicators should be standardized and applied consistently across studies. Majority of papers included for the review were from the developed world i.e., North America, Japan, Europe and China and it will be interesting to know how transport mobility and transport accessibility relates with quality of life in developing world where the city structures are contextually different and problematic. A comparative study between the two different world scenarios can also be attempted for the first time to have interesting results. Quality of life and the topic of life satisfaction is a very subjective experience therefore it will be interesting to research how quantiles with different personal characteristics, i.e., income and education will affect the relationship between travel and quality of life.

## 5 References

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