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A Critical Review of Factors Affecting Usage of Active Modes in Urban Mobility

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Abstract - *This study examines the multifaceted determinants of walking and cycling mode choice, exploring the intricate interplay of demographic, trip-related, design, and perception attributes. Drawing from a synthesis of literature spanning from the late 1990s to the early 2010s, the research elucidates the evolving landscape of factors influencing active transport behavior. Key findings reveal a complex web of influences, including the impact of car ownership, age, gender, socioeconomic status, trip distance, urban design elements, and safety perceptions. Insights from various authors underscore the dynamic nature of active transport preferences, highlighting the need for comprehensive analyses to understand the factors shaping mode choice. The review underscores the necessity for comprehensive analyses to understand the multifaceted influences on walking and cycling behavior, emphasizing the importance of a holistic approach to urban mobility planning.*

Key Words: Active modes, urban mobility, mode choice, infrastructure, safety, socio-demographic, environmental conditions.

1.INTRODUCTION

Active modes of transportation, such as walking and cycling, play a crucial role in promoting sustainable urban mobility, enhancing public health, and mitigating environmental impacts associated with motorized travel. Understanding the factors influencing the choice of active transport modes is essential for urban planners, policymakers, and researchers seeking to promote their uptake in urban environments. Over the years, numerous studies have explored the complex interplay of demographic, socio-economic, environmental, and behavioural factors shaping individuals' preferences for walking and cycling.

Researchers such as (Ortuzar et al., 2005), (Parkin, 2008, and Wardman et al., 2007) have highlighted the importance of factors such as car ownership, age, and gender in influencing the propensity to use non-motorized modes of transport (Ortuzar, Iacobelli, & Valeze, 2005; Parkin, 2008; Wardman, Hatfield, & Page, 2007). Additionally, studies by (Badoe and Miller, 2000), (Cervero, 1996), and (Leslie, 2007) have underscored the significance of land use patterns, urban design, and access to amenities in shaping active transport behaviour (Badoe & Miller, 2000; Cervero, 1996; Leslie, 2007).

As cities worldwide strive to promote sustainable mobility options and reduce reliance on automobiles, a deeper understanding of the factors influencing the usage of active transport modes becomes imperative. This paper aims to provide a critical review of the key attributes identified in the literature that affect the usage of walking and cycling in urban mobility. By synthesizing insights from a diverse range of studies, we seek to offer valuable insights for policymakers, planners, and researchers engaged in fostering more walkable, bike-friendly cities

2. Factors effecting Active Transport

Numerous studies have investigated the impact of various factors on walking and cycling mode choice, shedding light on the complexities of active transport preferences. (Ortuzar et al., 2005) and (Parkin, 2008) observed a negative correlation between increasing car ownership and bicycle mode choice, indicating a potential deterrent to non-motorized travel (Ortuzar, Iacobelli, & Valeze, 2005; Parkin, 2008). Conversely, (Wardman et al. , 2007) found age to have a negative effect on cycling in Britain, whereas (Plaut, 2005) identified a positive influence of age on walking and cycling in the United States (Wardman, Hatfield, & Page, 2007; Plaut, 2005). Additionally, (Noland and Kunreuther, 1995) reported a positive inclination for males to use walking and cycling modes, while (Agrawal and Schimek, 2007) noted a negative likelihood for males to walk.

Further insights from (Buys and Miller 2011) suggested that perceived transport convenience varied based on journey destination and purpose, influencing travel mode choice. Correspondingly, (Ortuzar, 2000) found a positive association between school trips and bicycle usage. Land-use and population density were also highlighted as significant factors impacting non-motorized transport mode choice. (Badoe and Miller, 2000) discussed mixed findings regarding the effects of land-use and density, while (Cervero, 1996) and (Cervero and Kockelman, 1997) reported positive correlations between non-motorized transport use and mixed land-use, as well as high density. However, (Rodriguez and Joo, 2004) noted inconsistent relationships between non-motorized mode choice and

increasing density, emphasizing the need for a nuanced understanding of these factors.

Moreover, (Rodriguez and Joo, 2004) emphasized the importance of considering additional factors such as vehicle ownership to avoid overestimating the influence of environmental factors. This highlights the complexity of active transport mode choice and the necessity for comprehensive analyses in understanding the factors shaping it.

2.1 Demographic attributes

Demographic and socioeconomic characteristics play a significant role in influencing active transport mode choice, as evidenced by numerous studies. Age, gender, and ethnicity emerge as key factors shaping non-motorized travel behavior. Young individuals exhibit a greater propensity for bicycling, while both the youth and elderly populations tend to rely more on walking compared to other age groups. Furthermore, a consistent finding across studies is that men are more inclined to bicycle than women, irrespective of whether it's for recreational or transportation purposes.

he presence of alternative transportation options, particularly access to private cars, diminishes the likelihood of individuals choosing walking or bicycling. Additionally, socioeconomic status plays a significant role, with lower-income households displaying a higher likelihood of engaging in walking and bicycling activities, even after controlling for vehicle availability. This underscores the intricate interplay between demographic factors, household characteristics, and individual preferences in shaping active transport behavior.

2.2 Trip attributes

Trip characteristics constitute another significant determinant of active transport mode choice, as highlighted in various studies. Among these characteristics, trip distance stands out as a well-established factor influencing non-motorized travel behavior. Generally, individuals are less likely to opt for bicycling or walking when the destination is farther away, holding all other factors constant. However, the impact of distance on mode choice may vary among individuals based on factors such as physical condition, attitudes, perception of distance, and the purpose of the trip.

Moreover, while distance is an objectively measurable parameter, its influence on mode choice is intricately linked to individual preferences and situational factors. For instance, bicycling tends to be more commonly utilized for recreational purposes compared to other trip purposes. This highlights the nuanced relationship between trip characteristics and active transport mode choice, emphasizing the need for a comprehensive understanding of individual preferences and contextual factors in shaping travel behavior.

2.3 Design attributes

urban design elements play a pivotal role in promoting the use of non-motorized modes of transportation, as evidenced by various studies. Factors such as the presence and continuity of sidewalks, bike lanes, and trails, coupled with adequate street lighting, create a conducive environment for walking and bicycling. Additionally, amenities that enhance the aesthetic appeal of a neighborhood, such as scenic views, well-maintained landscaping, parks, water features, shopping opportunities, and recreational sites, further contribute to the attractiveness of walking and bicycling for both recreational and utilitarian purposes.

Furthermore, the availability of play spaces within walking distance is crucial, particularly in neighborhoods with children, as it not only encourages physical activity among children but also reduces the need for parental transportation to access recreational opportunities. This underscores the importance of considering not only infrastructural elements but also the overall neighborhood environment in promoting active transport modes. A holistic approach to urban design that integrates both functional and aesthetic aspects is essential for creating environments that support and encourage non-motorized travel.

2.4 Perceptions attributes

Perceptions of safety play a crucial role in determining individuals' willingness to walk or bicycle. An environment perceived as safe for pedestrians and cyclists is a key determinant in promoting active transport modes.

Concerns such as busy traffic, the lack of pedestrian crossings, and the presence of major arterials are commonly cited as safety hazards by pedestrians and cyclists. These factors not only pose physical risks but also contribute to individuals feeling less comfortable and secure while walking or bicycling. Thus, addressing safety concerns and creating environments perceived as safe and conducive to active transport is essential in encouraging greater participation in walking and bicycling. This highlights the importance of considering both health-related motivations and safety perceptions in promoting active transport modes within urban environments.

The table below shows the key attributes referred by researchers on the context of factors influencing usage of active mode.

Table -1: Key attributes from available literature

Subcategory	No. of Appearances	Authors
Household Income	5	(Besser, 2005), (Gebel, 2011), (Shokoohi, 2012), (Owen, 2004), (Krizek, 2006)
Social Status	1	(Foster, 2004)
Educational Qualifications	1	(Besser, 2005)
Driving License	1	(Tajima, 2013)
Employment	2	(Foster, 2004), (Krizek, 2006)
Expenditure	2	(Foster, 2004), (Tajima, 2013)
Driving License	2	(Foster, 2004), (Tajima, 2013)
Age	8	(Dawson, 2007) (5), (Gebel, 2011), (Owen, 2004) (2)
Gender	4	(Besser, 2005), (Owen, 2004), (Shay, 2003), (Tsukaguchi, 2011) (2)
Race/Ethnicity	2	(Besser, 2005)
Marital Status	1	(Dawson, 2007)
Density	7	(Cervero, 1997), (Greenwald, 2001), (Leslie, 2007), (Azmi, 2012), (Cervero, 1997) (2)
Land Use Pattern	2	(Azmi, 2012), (Besser, 2005)
Mixed Land Uses	2	(Cervero, 1997), (Shay, 2003)
Connectivity	2	(Krizek, 2006), (Leslie, 2007)
Sidewalks	5	(Addy, et al., 2004), (Parks, 2006), (Shay, 2003), (Maghelal, 2011), (Owen, 2004)
Streetlights	2	(Addy, et al., 2004), (Owen, 2004)
Pedestrian Amenities	1	(Leslie, 2007)
Pedestrian-Oriented Design	1	(Cervero, 1997)
Design	4	(Foltete, 2007), (Krizek, 2006), (Addy, et al., 2004)
Aesthetics	5	(Brown, 2007), (Shay, 2003), (Kelly, 2011) (2), (Owen, 2004)
Distance	6	(Tsubono, 2002), (Sisiopiku, 2003), (Azmi, 2012), (Kelly, 2011), (Tsukaguchi, 2011) (2)
Safety	14	(Brown, 2007), (Shay, 2003), (Sisiopiku, 2003), (Addy, et al., 2004), (Greenwald, 2001), (Owen, 2004), (Tudor-locke, 2004), (Maghelal, 2011) (2)
Traffic	4	(Brown, 2007), (Shay, 2003), (Owen, 2004), (Tsukaguchi, 2011)
Natural Features	1	(Forsyth, 2009)
Weather	3	(Sisiopiku, 2003), (Shay, 2003), (Azmi, 2012)
Physical Activity	3	(Foster, 2004), (Lindelöw, 2014), (Brown, 2007)
Recreational Walking	1	(Forsyth, 2009)
Walking for Recreation	1	(Sugiyama, 2008)
Walking to Get to and from Places	1	(Owen, 2004)

Source: Fritz Akhmad Nuzir, Bart Julien Dewancker, 2016

The table presents a comprehensive overview of attributes influencing the choice of active transport, illustrating the evolving landscape of factors across different years as identified by various authors. Initially, in (Cervero, 1997) highlighted the significance of density in urban settings. Over the years, safety emerged as a crucial concern, with (Brown, 2007) emphasizing its importance, followed by (Shay, 2003 and Sisiopiku, 2003) focusing on safety aspects. By 2004, a broader spectrum of factors was recognized, including household income by Besser and physical activity by Foster. Subsequent years saw the exploration of diverse attributes such as age (Dawson,

2007), natural features (Forsyth, 2007), and perceived neighborhood greenness (Sugiyama, 2008), signifying a nuanced understanding of environmental influences. Notably, the importance of amenities like sidewalks (Addy, 2007) and pedestrian networks (Galderisi, 2010) gained prominence, aligning with efforts to enhance infrastructure. As the discourse progressed, the significance of convenience (King, 2011) and traffic-related factors (Brown, 2011) became more pronounced, reflecting a holistic approach to urban mobility. The inclusion of lifestyle considerations (Tajima, 2012) and attractor attributes (Wang, 2014) in later years underscores the complexity of decision-making processes. This progression underscores a dynamic shift towards a more comprehensive understanding of the multifaceted influences shaping the choice of active transport, as highlighted by various researchers over time.

3. CONCLUSIONS

The comprehensive examination of key attributes influencing the choice of active transport reveals a dynamic evolution in the understanding of factors shaping urban mobility preferences. Over the years, researchers have delved deeper into various aspects, ranging from demographic and socioeconomic characteristics to design elements, perceptions of safety, and environmental considerations. The progression from early emphasis on factors like density and safety to the recognition of amenities such as sidewalks, pedestrian networks, and recreational facilities underscores the multifaceted nature of active transport decision-making.

Moreover, the inclusion of lifestyle factors, convenience considerations, and the attractiveness of destinations within walking distance further enriches our understanding of the complexities involved in mode choice. The evolving discourse reflects a paradigm shift towards a more holistic approach that integrates infrastructural enhancements with broader environmental and socio-economic considerations. By acknowledging the interplay between individual preferences, neighborhood characteristics, and policy interventions, urban planners and policymakers can develop more effective strategies to promote active modes of transportation.

REFERENCES

[1] Addy, C. L., W. D., K. K., A. B., S. P., & K. D. (2004). Associations of Perceived Social and Physical Environmental Supports with Physical Activity and Walking Behavior. American Journal of Public Health, 440-443.

[2] Azmi, D. I. (2012). A Comparative Study of Walking Behaviour to Community Facilities in Low-Cost and Medium Cost Housing. Procedia - Social and Behavioral Sciences.

[3] Besser, L. D. (2005). Walking to Public Transit: Step to Help Meet Physical Activity Recommendations. American Journal of Preventive Medicine.

[4] Brown, B. B. (2007). Walkable Route Perceptions and Physical Features: Converging Evidence for En Route Walking Experiences. Environment and Behavior.

[5] Cervero, R. K. (1997). Travel Demand and the 3Ds: Density, Design, and Diversity. Transportation Research Part D.

[6] Dawson, J. e. (2007). Perceived Barriers to Walking in the Neighborhood Environment: A Survey of Middle-aged and Older Adults. Journal of Aging and Physical Activity.

[7] Foltete, J. P. (2007). Urban Layout, Landscape Features and Pedestrian Usage. Landscape and Urban Planning.

[8] Forsyth, A. e. (2009). The Built Environ-ment, Walking, and Physical Activity: Is the Environment More Important to Some People than Others? Transportation Re-search Part D.

[9] Foster, C. H. (2004). Environmental Perceptions and Walking in English Adults. Journal of Epidemiology and Community Health.

[10] Galderisi, A. C. (2010). Soft Mobility and Pedestrian Networks in Urban Areas. Journal of Mobility, Land Use, and Environment.

[11] Gebel, K. e. (2011). Mismatch between Perceived and Objectively Assessed Neighborhood Walkability Attributes: Prospective Relationships with Walking and Weight Gain. Health and Place,.

[12] Greenwald, M. B. (2001). The Built Environment as a Determinant of Walking Behavior; Analyzing Non-Work Pedestrian Travel in Portland, Oregon. Recent Work. Irvine: Center for Activity Systems Analysis. Institute of Transportation Studies (UCI).

[13] Kelly, C. e. (2011). A Comparison of Three Methods for Assessing the Walkability of the Pedestrian Environment. Journal of Transport Geography.

[14] King, W. e. (2003). The Relationship between Convenience of Destinations and Walking Levels in Older Women. American Journal of Health Promotion.

[15] Krizek, K. (2006). Lifestyles, Residential Location Decisions, and Pedestrian and Transit Activity. Transportation Research Record.

[16] Leslie, E. e. (2005). Residents' Perceptions of Walkability Attributes in Objectively Different Neighbourhoods: a Pilot Study. Health and Place.

[17] Leslie, E. e. (2007). Walkability of Local Communities; Using Geographic Information Systems to Objectively Assess Relevant Environmental Attributes. Health and Place.

[18] Leyden, K. (2013). Social Capital and the Built Environment: The Importance of Walkable Neighborhoods. American Journal of Public Health.

[19] Lindelöw, D. S. (2014). hat limits the pedestrian ? Exploring perceptions of walking in the built environment and in the context of every-day life. Journal of Transport & Health.

[20] Maghelal, P. (2011). Investigating the Use of Virtual Reality for Pedestrian Environments. Journal of Architectural and Planning Research.

[21] Manaugh, K. E.-G. (2011). Validating Walkability Indices: How Do Different Households Respond to the Walkability of Their Neighbourhood? Transportation Research Part D: Transport and Environment.

[22] Owen, N. e. (2004). Understanding Environmental Influences on Walking: Review and Research Agenda. American Journal of Preventive Medicine.

[23] Owen, N. e. (2007). Neighborhood Walkability and the Walking Behavior of Australian Adults. American Journal of Preventive Medicine.

[24] Parks, J. S. (2006). Characterizing Neighborhood Pedestrian Environments with Secondary Data. Transportation Research Part D,.

[25] Shay, E. S. (2003). Walkable Environments and Walking Activity.

[26] Shokoohi, R. H. (2012). Children Walking to and from School in Tehran: Associations with Neighbourhood Safety, Parental Concerns and Children's Perceptions. Procedia - Social and Behavioral Sciences.

[27] Sisiopiku, V. A. (2003). Pedestrian Behaviors at & Perceptions towards Various Pedestrian Facilities: An Examination based on Observation & Survey Data. Transportation Research Part F.

[28] Sugiyama, T. e. (2008). Associations of Neighbourhood Greenness with Physical and Mental Health; Do Walking, Social Coherence and Local Social Interaction Explain the Relationships?. Journal of Epidemiology and Community Health.

[29] Tajima, Y. e. (2013). elationships among Lifestyle Attributes toward Pedestrian Facilities. Proceedings of the Eastern Asia Society for Transportation Studies.

[30] Tsubono, Y. e. (2002). Validation of Walking Questionnaire for Population-based Prospective Studies in Japan: Comparison with Pedometer. Journal of Epidemiology.

[31] Tsukaguchi, H. e. (2010). Comparative Study of Pedestrian Travel Culture in Different Cities in Japan. Journal of the Eastern Asia Society for Transportation Studies.

[32] Tsukaguchi, H. e. (2011). Effect of the Stage of Life and Lifestyle on Pedestrian Behavior in East Asian Countries. Journal of the Eastern Asia Society for Transportation Studies.

[33] Tudor-locke, C. B. (2004). How Many Steps/Day are Enough? Preliminary Pedometer Indices for Public Health. Sports Medicine.

[34] Wang, W. e. (2014). Microscopic Modelling of Pedestrian Movement Behavior: Interacting with Visual Attractors in the Environment. Transportation Research Part C.