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PROVIDING MOBILITY SERVICES FOR OLDER ADULTS IN URBAN AREAS WITH AN AI SUPPORT-INTELLIGENT MANAGEMENT IN PUBLIC TRANSPORT

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ABSTRACT

Purpose: *This paper analyses the challenges for urban mobility in creating transport services for older adults, including Intelligent Management with the support of Artificial Intelligence (AI) solutions. It emphasizes sustainable mobility goals through the reduction of car dependency and the promotion of public transport, along with increasing mobility among older adults and limiting social exclusion.*

Need for the study: *The paper shows a holistic approach to transport service provision aimed at promoting aging-in-place and creating age-friendly cities with inclusive transportation systems, which might be made with AI help. It analyses the diversity of mobility needs of the growing demographic group of older adults, including specific domains of life, habits, and factors determining daily mobility.*

Methodology: *The study presents a theoretical process model for developing transport services that address the needs of older adults. It includes the most important issues related to the creation of sustainable mobility options with the main aim of reducing social exclusion.*

Findings: *The research shows that providing safe and attractive mobility solutions that reduce car use in favour of public transport and other forms of urban mobility is crucial for supporting multimodal and sustainable travel patterns. It also enhances the quality of life of older adults and their independence, allowing them to age in place.*

Practical Implications: *The proposed model serves as a starting point for policymakers and transport service providers to shape the accurate level of transport services and create liveable and sustainable urban environments for all.*

Keywords: public transport, transport services, AI, Intelligent Management, mobility needs of older adults, transport management, aging in place

JEL codes: J11, J14, O18, R40, R41, R42

2. INTRODUCTION

The aging population in urban areas, especially Europe, has become a growing concern. Older adults face unique challenges related to their daily mobility. As people live longer, the issue of creating age-friendly cities with efficient and inclusive transportation systems became a crucial task

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(Lin & Cui, 2021) Also, the growing older population is highly diverse in regard to multiple features, such as age, income, location, and above all- health (Haustein & Siren, 2015; Webber et al., 2010).

Older adults face multiple obstacles related to their limited mobility due to factors such as declining health, different disabilities, and lack of or limited access to private vehicles. This may lead to social exclusion and isolation, which may lead to reduced quality of life and/or reduced levels of social participation. Thus, mobility is closely related to health status and quality of life (Groessl et al., 2007; Plouffe & Kalache, 2010).

According to Eurostat projections, the baseline scenario projects that the current pattern of population ageing in the EU is likely to continue until 2100, with both the size and the proportion of older persons in the total population increasing. The proportion of elderly (65 years and over) in the EU total population is projected to increase from 21.1% (94.3 million) at the beginning of 2022 to 32.5 % (136.1 million) in 2100. As such, the share of elderly persons is projected to rise by +11.4 pp, corresponding to an additional 41.8 million persons by 2100. With the overall EU population declining by 2100, this is the only leading demographic age group that is projected to grow, both in relative and absolute terms, indicating a continuation of population ageing (*Population Projections in the EU*, 2023). Those changes will obviously affect almost every aspect of society and the economy, including the transport sector.

This paper aims to explore the subject of a process model of shaping the value of urban transport services that address older adults' mobility needs along with using Intelligent Management in public transport. Based on synthesis of identified segments of older adults and factors that are relevant in terms of older people's mobility patterns, the hypothetical model was proposed, integrating the most relevant determinants of older adults' mobility patterns and their interrelations including AI support.

3. LITERATURE REVIEW

Mobility itself might be presented as a (Scheiner, 2006) chance to meet one's need, the goals of 'unfulfilled activity wishes' and also 'satisfaction with out-of-home leisure activities. It can also be broadly defined as the ability to move using different means, i.e., by walking, by using assistive devices, or by using transportation. Area of mobility covers community environments that expand from one's home to the neighbourhood, and to regions beyond (Webber et al., 2010). WHO presented mobility in a broader way, including both indoor and outdoor movement as well as the use of assistive devices and transportation(International Classification of Functioning, Disability and Health (ICF)).

The mobility of older adults has been the focus of numerous empirical studies. Nevertheless, there are multiple challenges of urban aging, and they require a comprehensive approach to address the mobility needs of this group. Older adults often face numerous problems while accessing public transport services. Those barriers are related to infrastructure accessibility, smart solutions (like journey planners and navigation tools), and access to current information about connections of public transport networks and cancelled courses (Loos et al., 2020; Maresova et al., 2023a).

In addition, the lack of flexible and community-based transport options further limits the mobility of older adults and also, as Kim et al. highlighted (Kim et al., 2019) – when older people do not undertake out-of-home activities it may be caused by lack of transport options or an unfriendly environment, rather than having no need to travel. Mobility is crucial in terms of active aging, as it allows older adults to maintain their independence, participate in physical activeness, engage in social and community life as well as give the possibility to access necessary resources (Maintaining Mobility and Preventing Disability Are Key to Living Independently as We Age | National Institute on Aging).

Moreover, mobility is a key component of aging in place, which refers to the possibility for older adults to choose to continue living in their own homes and neighbourhood despite aging (Mestheneos Elizabeth, 2011). Indeed, this is possible if the provision of services, including transportation, is adequate (Davies & James, 2016; Gilleard et al., 2007; Gonyea & Burnes, 2013).

Outdoor mobility refers to the physical ability to move, and it also refers to all types of trips outside home, either by foot or other types of transportation (Rantanen, 2013). Physical activity, at any age, can reduce the risk of chronic diseases (i.e., cardiovascular diseases, type 2 diabetes, stroke, and certain

types of cancer), but also can help to prevent depression, dementia, and cognitive impairment. As chronic diseases are found to be more prevalent among older adults, and as the global number of this group is still rising, this implies enormous healthcare costs (Mertens et al., 2019).

The aging population is increasingly diverse, and this diversity is no longer considered a homogeneous group, but it is divided into meaningful segments according to number of studies. Various studies segment the older population into homogeneous groups based on a combination of various factors: demographic, health-related, and transport-related(Cui et al., 2017; Lin & Cui, 2021), which all interact with domains of life(Isaacson et al., 2020).

3.1. Factors and Determinants of Older Adults' Mobility Patterns

It is important to base mobility patterns on a theoretical background and on variables that have been found within different, more general studies and are relevant predictors for explaining mobility behaviour(Haustein & Hunecke, 2013). Analysis of mobility behaviour factors can be included in cluster analysis. When considering, for example, a population of older people, it is understandable to include factors such as age, income, accessibility, and the social network, which are important factors in older people's mobility behaviour. Numerous scientific journals describe those approaches, but from the point of view of this paper, it is necessary to include the most common factors that refer to the mobility needs of older adults in terms of model creation.

From the point of view of this paper, based on existing studies the concept of mobility is portrayed through five fundamental categories of determinants: cognitive (Shoval et al., 2011; Ullrich et al., 2019), psychosocial (Isaacson et al., 2020; Wu et al., 2021), physical (Portegijs et al., 2014; Tokey, 2021), environmental (Kramer & Pfaffenbach, 2016; Rantakokko et al., 2016) and financial (Frantál et al., 2020; Sanchez et al., 2017), which will later on be named as domains of life of older adults. And those basic categories are influenced by more general mobility determinants, including age, gender, culture, car access, etc. (Maresova et al., 2023a; Webber et al., 2010) (Table 1).

Table 1. Mobility-related domains of older adults' life

Mobility-related domains of older adults' life				
Cognitive:	**Psychosocial:**	**Physical:**	**Environmental:**	**Financial:**
• Mental status; • Memory; • Speed of processing; • Executive functioning	• Self-efficacy; • Coping behaviours; • Depression; • Fears; • Relations with others that affect one's decisions; • Perceived benefits; • perceived barriers, • social norms; • Social support	• Stamina; • Physical activity; • Physical barriers	• Driving in the night/rain (poor weather conditions); • Weather dependency; • Type of infrastructure; • Outdoor terrain • Home location; • Neighbourhood; • Distance • Residence characteristics; • Social interactions	• Level of income

Source: own elaboration based on (Isaacson et al., 2020; Maresova et al., 2023a; Mertens et al., 2019; Ragland et al., 2019; Webber et al., 2010).

Siren and Hakamies (2016) explained the reasons why traditional approaches in mobility and travel behaviour fail to identify the mobility needs of older adults. Mobility- usually perceived through travel behaviour, demands, preferences, choices, satisfaction, and activity patterns, may not be sufficiently effective to allow specific insight into the needs of different age populations, in this case, older adults (Siren & Hakamies-Blomqvist, 2005). Each age group has its special features and characteristics that impact travel behaviour and also mobility needs.

When considering older adults, there is a need to highlight the relevant heterogeneity with regard to age, gender, and health conditions (Luiu et al., 2017). The group of demographic factors (Figure 1) have a greater or lesser extent impact on mobility behaviour, such as: (Barišić et al., 2024; Haustein & Hunecke, 2013; Johnson et al., 2020; Luiu et al., 2017; Mercado et al., 2010)

a) Age: which is multidimensional, and there are multiple ways to define 'old age', including: chronological age, functional capacity, or major life events like retirement or widowhood.
b) Gender: which is strongly related to other factors, especially car access, being licensed as a driver, and income, with women being disadvantaged across all factors. Due to longevity compared to men, the majority of the oldest and thus the physically most fragile population is female.
c) Income: Older people with a higher income make more trips, are more likely to drive, and are less likely to use public transport. On the other hand, financial concerns are one reason why older people stop driving a car.
d) Education: a higher level of education is associated with a higher probability of a more positive self-assessment of successful aging, especially in the case of projection of better financial status after retirement.
e) Employment status and retirement: which is also strongly related to other factors, as health has an effect on retirement and retirement may have an impact on health and travel patterns.
f) Household structure and related transitions: it is more likely not living in a single household that reduces mobility but the fact that people who live in single households are older, more often widowed, female, and less healthy.
g) Built environment: car-dependent older adults were more often found in rural districts and multimodal and service-dependent seniors in urban districts. Also, in rural areas, car access is often a precondition to independence, and in urban areas, where there are more mobility options, it is not that common. This factor also includes environmental barriers such as high curbs, lack of sidewalks, and missing environmental facilitators, etc.
h) Car access: is a factor that is found to be associated with better physical and mental health and well-being. Car use and its access are also linked to built environment factors, household structure, and gender.
i) Health: stays in relation to the social and productive activities of older adults. On the other hand, health restrictions reduce older people's activity frequency and increase their unfulfilled activity wishes (stroke, depressive symptoms, obesity, etc.). Older people's health is affected by the built environment and car access and also thereby influences mobility.
j) Social network/ physical capabilities and activities: which play an important role in later life. As for post-retirement persons, social and leisure activities form a larger share of their travel to a larger extent than for working people. On the other hand, for people with restricted mobility, the social network is crucial in order to conduct any out-of-home activities. Without the option to drive, older adults often depend on their social network to get a lift. Social networks are strongly related to older people's activity frequency, diversity, leisure distance, and leisure satisfaction.

The abovementioned factors might be put into more general groups of determinants, just as it has been shown in other studies (Luiu et al., 2017; Maresova et al., 2023a; Webber et al., 2010). However, those groups vary, according to existing research in this field. It is important to underline that health status related to age may require special transportation services, as older adults with disabilities or chronic health conditions may require different types of dedicated services. But those also vary according to income. In some cases, there is only the possibility to use wheelchair-accessible vehicles, door-to-door assistance; on the other hand, when the income is relatively higher, there might be a chance to use private vehicles(Musselwhite et al., 2015), taxis, and other types of ridesharing services. Those services play a meaningful role in maintaining the mobility of older adults and independence, limiting social exclusion. However, the burden of transportation costs still poses a significant challenge.

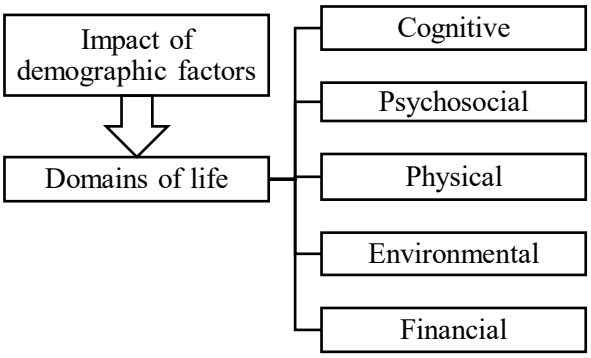

Figure 1. Demographic factors and domains of life as a main determinants of mobility behaviour determinants
Source: own elaboration.

As suggested by Musselwhite (2019), a model of age-friendly transport should cover (in concentric rings around the individual)-walking and cycling, followed by public and/or community transport, and then it all should be surrounded by age-friendly strategy and policy (Musselwhite & Scott, 2019). Improving the mobility of older adults is a process-based approach of multidisciplinary collaboration and coordination with other urban policies and projects, including health, infrastructure, and land use, so it meets the needs of the older adult population (Aguiar & Macário, 2017).

3.2. Mobility types among older adults

The literature directly shows that older adults' mobility needs and preferences are diverse. It all relates to "mobility styles" (Haustein & Hunecke, 2013), which can be regarded as a further development of the lifestyle approach. It is essential to underline that mobility-related attitudes and preferences are highly integrated with the life styles (Haustein & Hunecke, 2013; Lanzendorf, 2002; Ohnmacht et al., 2009). In addition, each generation of older adults has different travel patterns due to longer life expectancy, technology development and more diverse social offer (Cui et al., 2017).

The longest-term decisions made by individuals are the choice of a lifestyle, and the short-term decisions are the daily travel choices. Lifestyle is defined as the pattern of behaviour which conforms to the individual's orientation toward the three primary roles: as a household member, as a worker, and as a consumer of specific leisure types related to available resources (Salomon & Ben-Akiva, 1983). Understanding and identifying an individual's lifestyle is highly important while explaining an individual's behaviour, and travel behaviour as well.

There are various segmentation of mobility types approaches: behaviour base (Ohnmacht et al., 2009; Prillwitz & Barr, 2011), geographic segmentations (Aditjandra et al., 2012; Scheiner, 2006), sociodemographic segmentations (dependent on lifestyles and life stages)(Hildebrand, 2003; Hunecke et al., 2008; Salomon & Ben-Akiva, 1983), mobility styles and mobility types (Anable, 2005; Haustein & Hunecke, 2013; Lanzendorf, 2002; Ohnmacht et al., 2009).

According to Cui et al. (Cui et al., 2017; Lin & Cui, 2021), major characteristics and challenges of the travel patterns of older adults are:

- As older adults age, the number of trips and trip distances decrease, particularly after 75 years old.
- Dependency on private vehicles as the primary mode of transport continues, except for those aged 85 years or more.
- As older adults age, the importance of social relations and shopping trips increases, except for those aged 85 years or more.

In the literature, we can find terms related to 'aging in place' (Alley et al., 2007; Luiu et al., 2017). It is found to be one of the key determinants for the availability and accessibility of public transport, which is also related to the independence of older adults. And so, it can be seen that a lack of transportation options, including public transport, can significantly lower older adults' access to healthcare, social activities, and other services, finally causing social exclusion. 'Aging in place' in

relation to transportation enables older adults to remain in their homes and communities as they age. Luiu et al. (Luiu et al., 2017) emphasize the importance of accessible transportation options for older adults to maintain their independence and access essential services and social activities.

As proposed by Haustein and Siren (Haustein & Siren, 2015), there are four main segments of older adults:

- affluent mobile drivers (predominant car use, high activity engagement),
- car-dependent seniors (predominant car use, low activity engagement),
- mobile multi-modal seniors (use of all modes, medium to high activity engagement),
- and transport service dependent seniors (walking, public transport, and car use as passenger, low activity engagement).

Siren et al. grouped the transport needs of older adults into two main categories: 'serious needs', including medical appointments and emergencies, and 'discretionary needs', including spontaneous trips, visiting friends and relatives, and in general, achieving pleasure(Siren & Haustein, 2016). Some life events (e.g., related to the accidental lower health condition, changing the place of residence, losing a spouse who was a driver for the couple) have an impact on changing one's mobility profile suddenly and substantially (Webber et al., 2010). It is worth noting that not all older adults will have to cope with all of the mobility factors presented in this paper.

4. INTELLIGENT MANAGEMENT IN PUBLIC TRANSPORT- AI SUPPORT FOR MOBILITY SERVICES FOR OLDER ADULTS

Urgent and creative solutions are needed to enhance the independence and well-being of older adults, given the growing worldwide aging population. Artificial intelligence (AI) and robotics have emerged as viable technologies to address these issues.

Given the increasing interest in this topic, the term 'Gerontechnology' was coined to indicate an interdisciplinary field linking existing and developing technologies to the aspirations and needs of aging and older adults (Bronswijk et al., 2009; Chen, 2020).

We can identify three main fields in which AI-powered systems can assist older adults in their everyday lives: health, home-related issues, and mobility. Wearable technology powered by AI can track vital signs and activity levels, encouraging a more autonomous and healthy way of living.

AI-enabled smart home technologies can assist people in achieving their independence and lessen their dependency on both official and informal caretakers, such as family members. For example, AI algorithms in cutting-edge home applications can identify departures from typical behaviour patterns and promptly notify users of emergencies. Domestic robots can also assist with tasks such as carrying objects, answering queries, or finding misplaced objects (Czaja & Ceruso, 2022). Furthermore, AI can be implemented in smart cities to assist and encourage the mobility of senior citizens through the use of handheld devices, smartphones, tablets, and laptops that display information and have touchscreens or keyboards for entering instructions or data(Arnold et al., 2024; Bokolo Jnr, 2024; Musselwhite, 2023).

Specifically, AI applications can help older adults with navigation (e.g., getting detailed step-by-step directions), planning (e.g., booking the journey), and exploration (e.g., asking for and receiving information about the surrounding environment and required Points of Interest for better environmental awareness).

Bokolo Jr. (2024) argued that older adults require help managing their daily mobility. Thus, AI can encourage safe, autonomous, and accessible mobility, particularly for those with physical disabilities, those in wheelchairs, those with legal blindness or vision impairment, those with sensory impairments, and those with learning difficulties. If an older person is hurt while walking across or within a city, AI can connect them to emergency help services and/or to families and caregivers. Text-to-speech, automatic voice recognition, and a graphical touch-based user interface are some multimodal interfaces used(de Arriba-Pérez et al., 2023).

Specifically looking at the public transportation systems, Bokolo Jr. (2024) highlighted their poor inclusiveness and accessibility to older adults. AI can assist this population segment in leaving bus or train stops or stations in this context. By quickly inquiring if the user needs assistance remembering a trip and verifying the itinerary or schedule, AI can assist older adults with memory loss and cognitive impairment. Moreover, AI might serve as a travel assistant by offering a range of accessible and

available modes of transportation and providing guidance in various zones. When departing from a new bus stop or station, it may provide detailed directions to destinations(Bokolo Jr., 2024).

Finally, looking at walkability, AI can improve it by offering solutions like haptic and audio vibrotactile/feedback indicator-based augmented systems for senior citizens(Sobnath et al., 2020).

However, Maresova et al. (2023b)highlighted the following obstacles in the usage of AI technologies by older adults:

1. Many seniors who may not even have a basic level of digital fluency and comfort may find it difficult to use mobility technologies because they demand a smartphone, internet connection, and the capacity to make online payments.
2. Many older adults need wheelchairs or walking aids, which can be challenging to get into and out of public transport or cars, such as autonomous vehicles.
3. Many older adults require door-to-door or hand-to-hand service because of difficulties like recognizing the autonomous vehicle when it arrives, stowing and retrieving bags or mobility aids, locating the right door at complicated locations like hospitals or shopping centers, and physically navigating busy streets and sidewalks.

Finally, integrating AI and robotics in geriatrics presents serious ethical problems. Strong security measures and transparent consent processes are necessary to allay privacy concerns about collecting and using personal data. It is essential to create policies and rules that guarantee the ethical and responsible use of these technologies(Padhan et al., 2023).

To conclude, with the abovementioned cautions, AI technologies can contribute to aging in place or living in a familiar and comfortable environment for as long as possible.

5. MATERIALS AND METHODS

The existing literature emphasizes the crucial role of public transport in addressing the mobility needs of older adults, instead of car usage. This issue is also crucial while meeting the goals of sustainable urban transport development. This research has focused on mobility beyond one's home, including different types of movement, but mainly using private vehicles and public transport, as in this case vehicles and other forms of transportation require more in-depth analysis, and creation of transport services for older adults in order to maintain access to essential services, activities, and people, also including support from AI.

Although there is no single solution to transport modelling, the basic principles, including strengths and limitations, are used with the presented theoretical model. A relatively good model includes various interventions, policies, and projects that can be tested for their performance against given objectives (Ortuzar S. & Willumsen, 2024). It is also important to include the most relevant indicators, which were analysed in this paper.

The paper presents the classic transport process model, which includes analysed mobility factors, demand and supply side, modal split, external and additional factors, and support from the side of AI. The classic model concentrates attention only on a limited number of travellers, in this case older adults, and travel decisions are not made in a particular order. The consumer-process approach to transport services quality management (Kryvoruchko et al., 2018) is also included in this model.

6. MODEL OF SHAPING THE VALUE OF TRANSPORT SERVICES

On the basis of factors that were identified in existing literature related to the travel behaviour of older adults, the theoretical model on how different determinants work together was prepared.

The model integrates the most relevant determinants of older adults' mobility needs, which were presented in Figure 2, in particular:

- Demographic factors.
- Domains of older adults' lives.

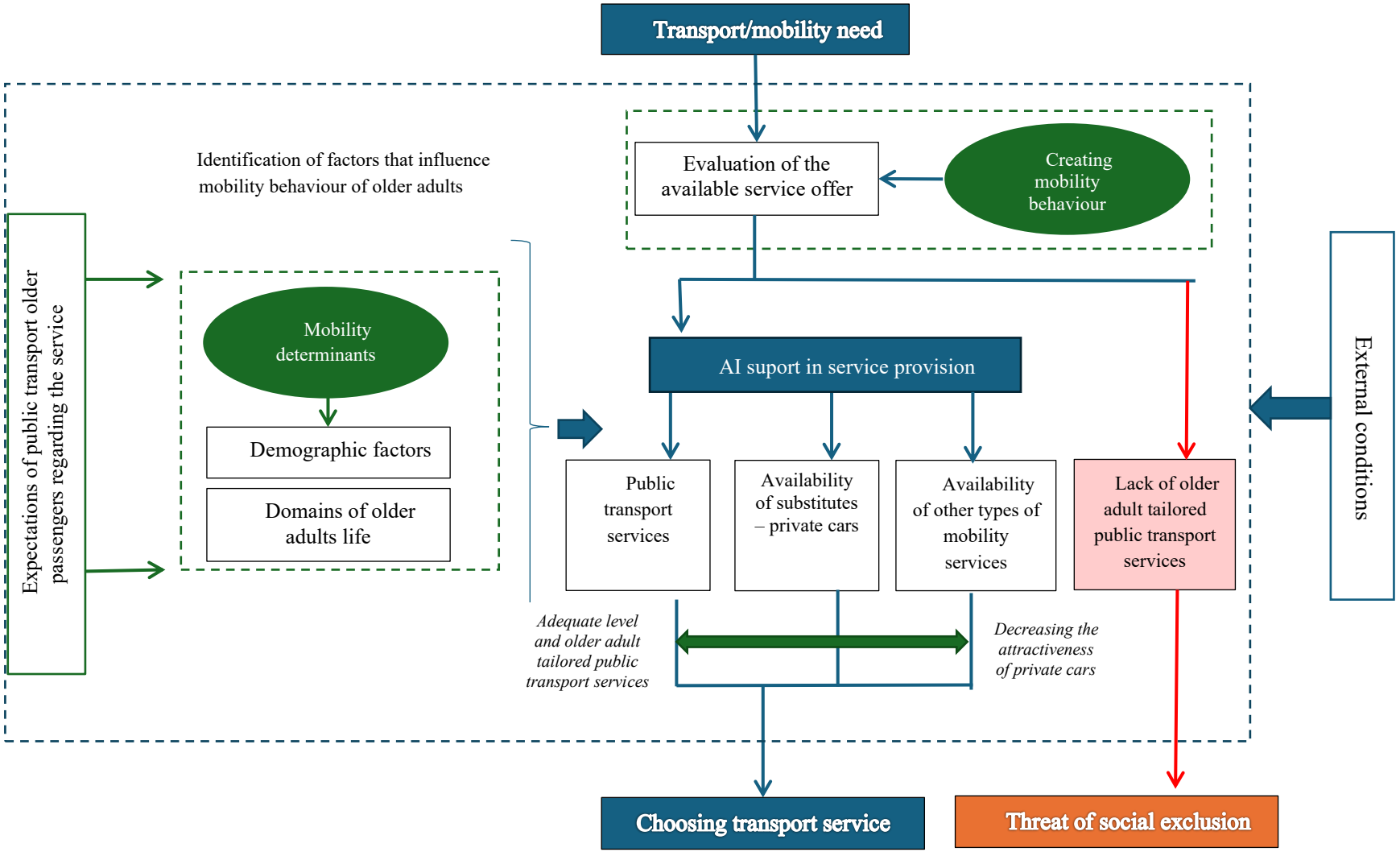

Figure 2. A model for shaping public transport and mobility services in relation to individual motorization, taking into consideration older adults' mobility needs

Source: own elaboration.

While the analysed needs and preferences of older adults are highly diverse, a general framework can be developed to understand the key factors that influence mobility behaviour and patterns within this group of adults. This framework might be helpful when creating public transport services that are demand-responsive and aligned to specific needs.

The proposed model serves as a starting point for policymakers and transport service providers to shape the accurate level of transport services and create liveable and sustainable urban environments for all.

7. DISCUSSION

In this study, it was shown that creating transport services for the group of older adults includes multiple and diverse factors. Reducing car-dependency by providing safe and attractive infrastructure for the safe use of active modes and better public transport services can be regarded as a key task to support multi-modal transport patterns. More and more often, in everyday life, we can see the use of modern technologies, one example of which is the implementation of Intelligent Management, which we can see through AI usage, also in the case of mobility services tailored to the needs of an aging society.

Designing age-friendly cities with inclusive transportation systems is crucial for enhancing older adults' quality of life and independence, allowing them to age in place. The process model presented in this paper, which prioritizes the unique values, needs, and preferences of older adults, might be a starting point for policymakers and also public transport services and mobility providers in the cities to shape the value of the transport services along with creating liveable and sustainable urban environments for all.

Staying active and independent in old age is also in line with the WHO's emphasis on Active Aging (Global Age-Friendly Cities: A Guide, n.d.). But also, as pointed out by Hakamies-Blomqvist, losing one’s mobility is not only a personal tragedy, but also a public health issue which might be seen through a chain of interrelated mechanisms (Hakamies-Blomqvist & Wahlström, 1998). Loss of mobility may occur when an older adult can no longer safely drive a car and/or when physical disabilities interfere with walking (Webber et al., 2010).

Knowing that the mobility model may be used to predict impairment and guide the design and interpretation of research studies, with additional value and information to city authorities and transport services operators is important. Development in the field of technology, including AI, also gives options that allow older adults to compensate for various mobility-related deficits (i.e., robotic walkers, driving assistants, and vehicle control devices, etc.) (Maresova et al., 2023a).

Addressing mobility challenges for older adults involves a multistakeholder approach, including healthcare providers, policymakers, urban planners, and families. Additionally, it is essential to regularly identify opportunities and monitor the development and usefulness of new solutions in mobility, in this case, possible ways of AI usage (Lui et al., 2009; Maresova et al., 2023a).

Based on travel patterns of older adults, and analysed factors that influence these patterns (Cui et al., 2017), the number of limitations of existing alternative transport options that are a threat to the mobility of older adults is as follows:

- Being a car passenger is an inconvenient and unattractive mobility option for older adults.
- Unreliable, poor-quality public transport services limit the number of trips as an alternative transport option.
- Accessibility restrictions for older adults with limited digital literacy.
- An unsupportive pedestrian infrastructure between home, transit nodes, and destinations also limits the use of public transport among older adults.
- Unfriendly pedestrian environments and poor urban design result in high-speed vehicular traffic and low ‘walkability’, which makes walking an unattractive option for older adults.
- The lack of safe cycling infrastructure and other support for safe cycling made this type of transport unattractive for older adults.

This theoretical model is presented to give different groups of stakeholders (especially city authorities and urban transport service operators) a chance to consider broadly the determinants of older

adult mobility and all of the interactions among them, also about AI support, in order to provide sufficient and accurate services, with the main hope to avoid social exclusion. This model may also give the possibility to establish new research for further development and analysis in the field of mobility factors in different mobility contexts.

Key discussion points include:

Multimodality: Promoting sustainable transport patterns is crucial. This also requires the provision of safe and attractive infrastructure, including active modes of transport, such as walking and cycling, alongside improved public transport services. Integrating these options allows older adults to choose the most suitable transport mode for their individual needs and abilities and avoid social exclusion.

Reducing Car Dependency: Car ownership offers convenience and flexibility, but it is not a sustainable option for all older adults. Declining health, disabilities, and financial constraints can limit access to private vehicles. Therefore, providing viable alternatives is crucial.

Age-Friendly Urban Design: Creating age-friendly cities requires a holistic approach that considers the needs of older adults in all aspects of urban planning, including transportation. This involves designing inclusive transport systems that are accessible, affordable, available, and safe.

The Value of Transport Services: The proposed process model emphasizes the importance of shaping the value of transport services to align with older adults' specific needs and preferences. This includes considering different and diverse factors.

Modern technology support: AI-powered transport services offer tailored solutions for older adults, creating a safer environment that contributes to their enhanced ability to live independently with autonomy as long as possible. AI-powered assistants used in daily mobility can help in the field of planning, designing, and tracking the physical activities of older adults with chronic diseases, ensuring they stay active and manage their conditions effectively. On the other hand, while using modern technology support (including AI), it is important to take into consideration the ethical issues surrounding data privacy.

Active Aging: Supporting active aging is also a key objective. Providing accessible transport options enables older adults to maintain their independence, participate in social activities, and access essential services, contributing to their overall health and well-being. This objective also includes considering various groups of older adults, including those with limited digital literacy.

The process model presented in the paper suggests that a more holistic approach is needed to fulfil the needs in the field of mobility assessment and treatment, and also broader consideration for the development of related policies and programs.

8. CONCLUSION

Reduced mobility among older adults is a complex problem that, in most cases, comes down to social exclusion. This paper shows a theoretical process model for creating services for older adults, taking into consideration the growing number of this group of city dwellers. The key determinants of mobility have been described to show, in detail, what must be considered while creating the services.

Based on the findings included in this paper, future research can focus on:

- In-depth analysis of how different factors concerning mobility interact and what added value and mobility outcomes can be created on the basis of this type of research.
- How to use AI efficiently in the field of daily mobility of older adults to avoid social exclusion.
- Further analysis of environmental factors, and how they can be managed to meet the goals of sustainable mobility in the cities.
- Suggestions in the field of public interventions that can improve selected determinants of mobility and assess their impact on health and well-being.

The model presented in the paper shows that all forms of movement are important and that many interrelated determinants influence mobility. Further research concerning the complex interactions between mobility determinants in different mobility contexts is needed. It should explore the practical implementation of the proposed process model in diverse urban environments and analyse its long-term impact. Additionally, in-depth studies should examine the role of technology, especially AI, in

enhancing transport accessibility and explore innovative solutions to address the evolving mobility needs of an aging population.

Considering that in most European countries the number of adults is increasing, the consumer potential for tailored services is also growing. This should and might be a strong motivation for transport service providers to develop innovative and supportive services for this group of inhabitants.

This study shows the complexity of transport services that need to meet the needs of older adults, but also in other countries that face rising demographic issues. One of the key issues is the reduction of car dependency by providing safe and accessible alternatives, such as public transport, walking, and cycling.

The proposed model, which prioritizes the unique values, needs, and preferences of older adults, offers a valuable framework for policymakers and public transport service providers. By adopting this model, cities can shape the value of transport services in ways that directly address the challenges faced by older adults.

Let's face the fact that creating age-friendly cities with inclusive transportation systems is not just a matter of convenience; it is crucial for enhancing the quality of life and independence of older adults.

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