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SilverBus: enhancing mobility for seniors through demand responsive transport: a pre-post experimental study

Claudia Burlando[1] · **Enrico Ivaldi**[2] · **Tiziano Pavanini**[3] · **Susanna Traversa**[4]

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Abstract
The increasing trend of population aging has heightened interest in public transport policies that promote active aging. Given the limited availability of public funds, it is crucial to identify best practices and methodologies to guide public policy investments effectively. This study underscores the importance of thorough development, testing, and ex-post validation of hypotheses in transport policymaking for the elderly. The research, which was based on the analysis of survey data (250 valid interviews) collected prior to and following the trial of 'SilverBus' – a Demand Responsive Transport (DRT) service designed for residents over the age of 65 in Genoa, Italy – highlights the importance of the trial phase. The findings demonstrate that pre- and post-test analyses are essential to contain public costs and enhance service quality. The construction of a logistic regression model further aids in identifying significant factors influencing the willingness to use a tailored urban public mobility service dedicated to the over-65 residents. This comprehensive approach ensures that transport services are effectively aligned with the actual needs of the elderly population, promoting active aging and efficient use of public resources.

Keywords Active aging · Demand responsive transport · Logistic regression model · Policy evaluation

Introduction

The contemporary world is experiencing a number of developments that are likely to have an influence on our approach to urban transportation planning. On one hand, increasing urbanisation and the depopulation of rural areas are fuelling the growth of megacities, some of which, with extremely high population densities, present serious difficulties for the functioning and development of services (such as healthcare and transportation). On the other hand, significant demographic slowdowns have contributed to the consolidation of silvery society models within metropolitan cities in Western Developed Regions (UN, 2022). In particular, a progressive increase in the population segment aged over 65 is expected by

Extended author information available on the last page of the article

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2050, whose share will reach 29.4% of the total population concerning the territory of the European Union on its own (Eurostat 2020).

Thus, the interest shown by European institutions over the promotion of policies that can limit socio-economic shocks connected to demographic transition have witnessed a steady increase (European Commission 2021). Tracing the main academic tendencies, there is a greatest interest towards understanding the economic costs derived from aging. Examples include studies that quantify the influence on the well-being and the welfare system – in terms of public health and retirement system spending – as well as on the slowdown in economic growth resulting from a contraction of the labour force (Pantelaki et al. 2021; Fatima and Moridpour 2019). As Crotti et al. reconstructed, in the advanced stages of life the dimension of well-being is dependent on the state of health and the level of independence enjoyed by the subject, which is able to affect both from a socioeconomic and psycho-motor viewpoint (Crotti et al. 2021). The risk of isolation, with a consequent impact on vulnerability toward depressive manifestations, as well as the lack of accessibility to primary services, makes the ability to move indirect as well as fundamental driver of the elderly person's well-being (Aguviar and Macaio, 2017; Gill et al. 2012; Mariotti et al. 2021). If structural, demographic aging becomes a key issue for policy makers, who need to either develop or redesign policies systems in order to make the management of seniority more efficient in terms of inclusiveness, sustainability and public spending (WHO, 2021).

Buehler and Nobis (2010) noted an increased awareness in the strategic role played by the transportation sector (Wong et al. 2018; Burlando and Cusano 2018; Cirella et al. 2019; Olawole and Aloba 2014), also confirmed by EU Institutions as a formal driver of active aging strategies (AA) (AGE 2021), which can be described as a concept promoted by the WHO that points to the physical and mental activity of older people as the way to healthy ageing. The objective is the participation of the elderly in economic and social life: physical activity, social life and participation must be supported and promoted (Burlando and Cusano 2018).

Acting directly on quality-of-life determinants for seniors could promote also the age-in-place philosophy (Mariotti et al. 2018) stemming the risk of "age-segregation" by fostering an urban environment modelled on "age integration" (Lucantoni et al. 2022; Desrosiers et al. 2004; Gill et al. 2012; McDonald et al. 2023).

Yet, the heterogeneity of elderly needs complicates the identification of consistent transportation demand determinants, especially on account of the paucity of investment in age-friendly environments and the non-transferability of service models among different urban realities (WHO, 2021; Fernández-Ballesteros et al. 2013; Meier and Werding 2010).

Over the years, academic research has sought to understand the main barriers to elderly's access to public transport (PT): some of the most significant problems have been linked to improper shelters, drivers' patterns of driving and vehicle timeliness, the absence of priority seating, and the high price of tickets (Wong et al. 2018; Lan et al. 2022).

In light of these issues hindering the full use of traditional local public transport (LPT) by the elderly, clearly emerges the need to introduce innovative solutions capable of improving accessibility, affordability, availability and acceptability of the over 65 (Cirella et al. 2019). Demand Responsive Transport (DRT) or *dial-a-ride* is one of the most promising technological solutions to provide a flexible and adaptable service to the real mobility needs of the elderly. The DRT combines the cost-effectiveness of bus transport with the capillarity of taxis (Mageean and Nelson 2003): this means that routes, timetables and stops are flexible

and depend on user requests (Häme 2013). DRT often makes it possible to maximize the load factor of vehicles, while providing cheaper and more reliable transport services (Papanikolaou et al. 2017). This technology has been tested worldwide to serve both densely populated areas and peripheral or rural contexts characterized by low transport demand (Pavanini 2023).

Despite its benefits, this solution is not widely used by specific groups of users. According to König and Grippenkoven (2020), one of the main barriers to the full development of demand-responsive transport (DRT) is users' lack of perceived usefulness. Therefore, solutions should consider the specific requirements of different user groups. In addition, there are significant complexities in older people's mobility due to difficulties in using technology at the booking stage (Leistner and Steiner 2017) and in travel planning due to the erratic nature of demand.

For this reason, in order to create DRT services tailored to the needs of the elderly, PTAs must thoroughly investigate the preferences and mobility attitudes of users through direct research. This needs to be done before the trial in order to calibrate the service to the real mobility needs of the users, and at the end of the test to check whether the users' expectations have been met or disappointed by the service, and thus to understand how to modify it accordingly.

The aim of this article is to demonstrate the importance of pre- and post-implementation validation of a mobility model specifically designed for the over-65 population, based on a Demand Responsive Transport (DRT) service. To this end, the SilverBus project, implemented in the city of Genoa, is used as a case study to analyse the effectiveness of this approach in addressing the mobility needs of elderly individuals. The SilverBus model can be replicated in different urban contexts thanks to its flexibility and adaptability to local needs.

Starting with a literature review that identified the main mobility characteristics and needs of the over-65 target group, the study introduces the SilverBus concept and highlights its distinctive features. Subsequently, the pre- and post-trial studies are presented. From a methodological perspective, these studies adhered to the criteria outlined in the literature for designing a service inspired by active aging.

Additionally, a logistic regression model was developed to predict the key factors influencing the use of the service prototype. Following the experimentation period, the collected results were validated through satisfaction surveys conducted on the sample of service users. In the "Results & Discussion" section, the main findings from the two surveys are presented and compared to validate the assumptions identified in the pre-trial phase. This comparison will support the identification of policy guidelines aimed at assisting policymakers in optimizing the service and ensuring a more efficient use of public funds. Finally, the "Conclusion" section provides a comprehensive summary of the key findings, discusses the limitations encountered during the study, and offers actionable recommendations for future research and service development.

Background research

The issue of transportation in ageing societies has grown in importance over the last decade, not only from an operational perspective but also from a research standpoint, as evidenced by a plethora of studies. This shows that researchers and policymakers are analysing and debating the importance and implications of the issue. However, further research is still required to comprehensively assess the multifaceted implications of ageing on transport systems.

One aspect noted throughout the literature review, and confirmed by (Lamellet and Haustein 2014), is that older people are commonly classified as "people with disabilities". In fact, the issue of mobility in the academic literature tends to concern at the same time the most vulnerable categories of users: the elderly, the disabled, low-income families, etc. (Azevedo et al. 2021; Norrbom and Stahl 2022). In this regard, efforts explicitly targeting older people (e.g. in Europe) are becoming more common in the areas of health, well-being and social integration, demonstrating how ageing is seen primarily as a medical issue, when in fact it also encompasses significant social, psychological, and economic dimensions. The baby boom generation is healthier, wealthier and far more 'mobile' than previous generations, and all these factors need to be considered when developing urban transport policies (WHO, 2015).

The rapid ageing of the population is an issue that affects all countries and is therefore studied on a global scale. Thaithatkul et al. (2022) investigated the key factors in the well-being of older people in Bangkok, Thailand, by relating an indicator of happiness ("subject well-being") to their travel behaviour and activities outside the home. The results confirmed the importance of active ageing: active older people were happier than inactive or less active people. The study also highlighted how public transport and out-of-home activities are factors closely linked to the mental and physical well-being of the elderly.

Understanding and studying the travel patterns of older people is crucial for planning inclusive transport systems that are accessible to the most vulnerable population groups. Busari et al. (2019) conducted a review of the existing literature on the mobility of the elderly, with the aim of identifying the elements that most influence their mobility dynamics. The study showed that the use and accessibility of public transport is a crucial factor in combating social exclusion among the elderly: the results showed that as people age, they tend to drive less, walk more and use more public transport. In addition, the results show that older people put more emphasis on distance and time in their travel dynamics.

Fatima et al. (2021) have also studied the travel dynamics of older people: in particular, the authors wanted to investigate how the use of public transport by older people is influenced by the duration of the trip, the time of day and accessibility.

The results, obtained through a spatial and temporal analysis, showed that older people prefer to use public transport during off-peak hours in the morning (from 10 am to 11 am) or in the afternoon (around 5 pm) and that there is a greater use of public transport for short trips. Furthermore, the preference of the elderly for public transport depends on the purpose of the trip: for trips to shopping centres, there is a greater use of the car, while for educational and recreational trips there is a good use of public transport.

Barriers to the mobility of older people were the subject of a literature review conducted by Che Had et al. (2023). Based on the assumption that limited mobility corresponds to reduced psychophysical well-being, the authors examined 32 articles published between

2011 and 2022 to identify the main barriers to the mobility of older people. The review process led to a classification of barriers into categories: health, built environment, socio-economic background, social changes and weather. Within this classification, public transport belongs to the built environment category: many articles found in the literature highlight how the problems of the elderly are mainly related to getting in and out of vehicles, the excessive distance they have to walk to reach bus stops, the inadequacy of shelters at bus stops, the unsafe environment, the general lack of respect, the driving style of drivers, etc. The results also showed how often public transport timetables and routes are planned by PTAs for people of working age, without considering the different times and destinations of the elderly.

The study conducted by Noorbom et al. (2022) also aims to understand the accessibility factors that influence the travel dynamics of older people in a Malaysian city. The results identify 4 different categories of factors: personal, temporal, land use and transport infrastructure. The most important of these appears to be the land use factor: the location of bus stops and destinations close to users' homes is the element that has the greatest impact on the mobility decision of the elderly.

The literature has also focused on policies aimed at increasing the accessibility of public transport for older people. Vecchio et al. (2022) studied different policy scenarios applied to the public transport system of Santiago de Chile, Chile: they evaluated the evolution of the accessibility of PT by intervening in the expansion of the metro network and the reduction of general public transport fares.

The results of this study show that the introduction of subsidised fares for the entire transport system brings greater benefits than infrastructure investments in the metro network: in the first case, the accessibility of the PT for the elderly increases to 34% (compared to 10.9% in the baseline scenario), while in the second case, it only reaches 14%. Furthermore, the authors suggest that policy makers should reduce transfers between metro and bus as much as possible in order to promote the mobility of the elderly and increase their satisfaction with the PT.

As the above literature highlights, the accessibility of public transport for older people is a key factor in combating social and economic isolation. Interventions in this area are particularly important for people who are forced to stop driving for health reasons.

It is generally accepted in the literature that when it comes to travel behaviour, people often stick to what they are used to and comfortable with for as long as possible (Burlando and Cusano 2018). In this regard, it is likely that baby boomers will continue to drive for as long as they can.

This trend is not positive as it presents serious implications for society: more elderly drivers lead to increased urban traffic, more polluting emissions and less road safety due to navigation problems, especially for the over-75s in unfamiliar locations (Hensher 2000; Currie and Delbosc 2010; Fatima et al. 2020), adverse weather conditions, darkness and the complicated orography of the area.

However, although older people prefer private transport to public transport and walking, they are forced to abandon car use when their health worsens (Fatima and Moridpour 2019).

Usually, this process is gradual: before abandoning car use completely, older people reduce the duration by limiting their trips within their own neighbourhood. The literature also highlights that the preferred mode of transport for the elderly remains the use of the car as a passenger, as they can count on the support of their family members (Musselwhite

2017; Cirella et al. 2019). Dedicated public transport services are therefore needed to persuade older people to give up driving early avoiding the externalities mentioned above and to provide a valid mobility option when they are no longer able to drive for health reasons.

In this respect, the literature suggests that people who are used to travelling by car for their daily trips are less inclined towards multimodality than those who usually use public transport. For this reason, public transport authorities must act to counteract this so-called "modal polarisation" of drivers through a better public transport offer aimed at rebalancing users' modal choices (ISFORT 2021). The implementation of a DRT service specifically for the elderly could attract users from private transport: once the elderly experience the benefits of this service, they are likely more inclined to use traditional LPT and other forms of mobility alternative to private cars.

In order to achieve successfully this goal, it is crucial that public transport operators carefully study the travel preferences and attitudes of the selected target users in order to create transport services that fully meet citizens' mobility needs.

To this end, this article intends to draw attention to the importance of the experimentation phase, in which it is possible to identify three distinct phases: the a priori study of users' expectations and needs, the creation of the service based on their requirements, and the subsequent verification of compliance with these requests. At the end of this process, the transport service can therefore be remodelled based on what has been learnt during the experiment, leading to a significant reduction in costs and an increase in user satisfaction. The literature also confirms the relevance of this process. According to Strömberg et al. (2016), pilot initiatives are an excellent tool for identifying significant changes in users' travel behaviour. While they do not fully realise their potential, it is important that the trials are perfectly tailored to the social and demographic context in which the experimentation takes place.

Despite the benefits of this transport solution, the academic literature has so far focused very little on elderly-specific transport options (especially DRT solutions): some of the main articles are listed in Table 1, in chronological order.

Innovation in urban transport service: the case of SilverBus

The experimental mobility service for seniors SilverBus, included within the GeTUP project, represents an example of a collective public transport service guided by AA goals and which reflects some of the main features discussed in the previous section, representing a case study of a public transport initiative tailored to the mobility needs of the over-65 population in Genoa, Italy.

This initiative aligns with the goals of active and healthy aging, addressing challenges posed by Genoa's demographic profile, which features one of the highest average ages in Italy (49.2 years) and an old age index of 266.9 (ISTAT 2023). Developed through a collaboration between the University of Genoa, AMT (the local public transport company), and a municipal hospital's geriatric unit, the six-month pilot (July–December 2022) sought to create a flexible, inclusive, and safe mobility service.

The service design was guided by pre-trial surveys on mobility habits and preferences of the elderly, highlighting the importance of comfort, safety, and accessibility. The service was designed to operate as an on-demand shuttle using traditional bus stops, emphasizing flexibility and inclusivity. Rides were mutually matched between users and providers, with

Table 1 Main scientific articles on elderly-specific public transport services

Author/s	Flexible transport solution	Research Topic (RT) / Methodology (M)	Results
Cheng (2011)	DRT	RT: The author argues that the use of dial-a-ride services is increasingly important in Taiwan for people with limited mobility such as the elderly and disabled. The author proposes a location-based service system capable of responding in real time to user requests and providing vehicle drivers with booking information. M: The author has set up a dynamic vehicle routing problem, which is solved using an ant colony algorithm.	The test has not yet been completed at the time of publishing this article. The results are not contained in the manuscript.
Broome et al. (2012)	DRT	RT: The authors intend to find out if a flexible transport service increases the use of the bus by the elderly and improves their degree of satisfaction compared to a traditional service. M: The use of the flexible bus was monitored for 9 months through the sale of tickets, while two surveys were conducted before and after the experimentation to assess the degree of user satisfaction.	The results of the study show that the use of the bus has practically doubled over the course of the trial (9 months). The degree of general satisfaction with the service has also grown significantly.
Leistner and Steiner (2017)	Ridesharing	**RT**: The authors analyse the performance of a new dynamic ridesharing service introduced within the traditional public transport and specifically dedicated to the elderly residents of Gainesville, Florida. The cost of this service, useful for increasing the movement of the elderly outside the home, was subsidized by the local government based on people's income. **M**: The study was based on a descriptive examination of the features of the trips made by the 40 senior adults enrolled in the program over the 9-month test.	The results of this study (35% of users made more than 5 trips a month) confirm that innovative transport tools such as dynamic ridesharing are able to increase mobility and accessibility to urban services for the elderly. Furthermore, this work confirms that the lack of specific skills in the use of technology by the elderly can negatively affect the use of new transport services such as ridesharing: however, this should only be a temporary problem, since the elderly of the future will be more familiar with technological devices. The main reasons for using it turned out to be: 1. Social-recreational; 2. Shopping; 3. Medical trips.

Table 1 (continued)

Author/s	Flexible transport solution	Research Topic (RT) / Methodology (M)	Results
Jittrapirom et al. (2019)	DRT	**RT**: The authors study the preferences of the elderly towards a Demand Transport Service (DRT) tested in the Netherlands in 2019: the aim of this work is to determine the DRT modalities preferred by the elderly in order to be able to put them into practice. **M**: The authors interviewed 4 industry experts, conducted face-to-face interviews with 38 elderly non-users of DRT, and submitted an online questionnaire to elderly DRT users (958).	In this study, the following factors emerged as important in the preferences of the elderly: 1. Short walking distance to embarkation points 2. Timeliness 3. Available of telephone booking and 3rd party booking 4. Integration of payment with PT card 5. Easy to use and clear Apps 6. Guaranteed seats 7. Possibility to pay with driver 8. Wheelchair and pram accessibility 9. Positive driver's attitude 10. Contact customer service via email 11. Bus stop amenities 12. Affordability 13. Safety 14. Personal interaction with the driver
Pinto (2020)	DRT	**RT**: The author analyses the potential of a specific DRT service for the elderly by understanding the characteristics that DRT must assume in urban areas (capacity, number of vehicles, etc.) and the travel habits of the elderly with traditional transport. **M**: In this regard, the author implements a DARP (Dial-A-Ride problem) algorithm, conducts sensitivity tests and applies a case study to the metropolitan context of Porto, Portugal. The objective of DARP is to minimize the kilometers travelled, the deadheading kilometers and the number of vehicles.	The results indicate that the optimal solution for a DRT service in Porto is an 8-seater vehicle. Furthermore, the study shows how the tested algorithm is efficient in the simulation of DRT services and can be used in the real context.

Table 1 (continued)

Author/s	Flexible transport solution	Research Topic (RT) / Methodology (M)	Results
Kersting et al. (2021)	DRT	**RT**: The authors analyse the drivers of elderly satisfaction in relation to a rural DRT service ("EcoBus") in Germany. **M**: The authors submitted a questionnaire (13 specific questions) to elderly people using the EcoBus rural DRT service and analysed the results.	The results show a higher degree of satisfaction with the DRT in the elderly than in other users and a better willingness to travel in groups (to cope with loneliness). This study indicates that the elderly are very much in favour of using alternative solutions to traditional transport.
Knierim and Schlüter (2021)	DRT	**RT**: The authors investigate the propensity to use DRT of people with mobility deficits, such as the elderly and disabled, in the context of a rural DRT. **M**: For the purpose of this research, a questionnaire was sent to 156 families living in the area of operation of the DRT service. The data were then analysed using linear regression.	The results indicate that car ownership hinders the full use of DRT, while physical problems favour its use. Furthermore, the more people live in small towns, the greater their willingness to use DRT: this is a consequence of a lower supply of traditional LPT.

Source: own elaboration

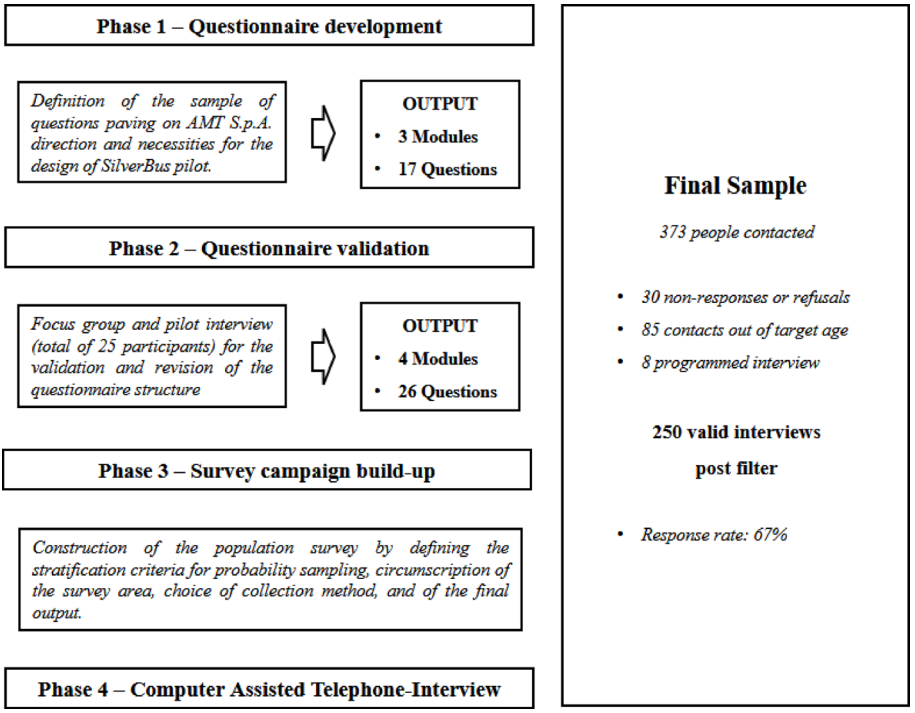

Fig. 1 Research design
Source: Authors' owns elaboration

vehicles offering only seating accommodations to enhance comfort and safety, particularly for frail passengers. While primarily aimed at active seniors, the service also accommodated individuals with limited mobility or those requiring a caretaker. A dual-channel booking system - combining a smartphone application with a traditional call centre - ensured accessibility for users with varying levels of digital literacy, addressing concerns about the potential exclusionary effects of fully digital mobility services (Bond et al. 2017; Dadashzadeh et al. 2022). Also, the project is free of charge, as are all forms of urban public transport, which are free for residents of Genoa aged 65 and over since 2023.

An additional innovative feature was the presence of an on-board steward, who not only assisted passengers with boarding and alighting but also guided them in using digital tools during pre-trip and in-trip phases. Surveys conducted before and during the pilot phase revealed that key factors influencing user satisfaction included perceived comfort, safety, driver competence, and vehicle crowding, aligned with Wong et al. (2017) and Chaisomboon et al. (2020). The choice of vehicles with only seating further enhanced flexibility and comfort, meeting the demand for priority seating for frail users. By integrating these features, SilverBus highlights how a tailored, validated public transport service can address the mobility challenges of aging populations while optimizing public resources and promoting active aging.

Methodology

Data collection

In order to adequately validate the service concept and its experimentation, two questionnaires were administered to the resident population: the first in the pre-trial phase (November 2021), aimed at understanding the mobility needs of the elderly in order to adequately design the service, and the second at the end of the 6-moth experimentation (February 2023), to evaluate the level of satisfaction of the service users and validate the assumption made in the first phase.

Considering the pre-trial phase, the build-up of the campaign consisted of four main phases (Fig. 1).

A prototype questionnaire was first designed according to the requests submitted by the Genoa local mobility company AMT S.p.A, with the aim of gathering information that would best respond to the service design requirements with 18 questions divided into three modules. Afterwards, through the realisation of two focus groups and a pilot telephone survey, the text of the questionnaire was submitted to 25 over-65 residents within the Municipality of Genoa. The set of questions of the survey was therefore edited following the feedback collected from the participants in the validation activities and confirmed by AMT S.p.A. The final version of the survey consists of a total of 26 questions, grouped into four modules: the socio-demographic section, reconstruction of travel habits, potential interest in a LPT service such as SilverBus, and the ability to independently use IT applications or aids to organise one's trips.

In order to ensure the representativeness of the sample compared to the demographic composition of the municipality of Genoa, the sample extraction methodology fell on a probabilistic approach. Contrary to non-probabilistic techniques, which are less used in

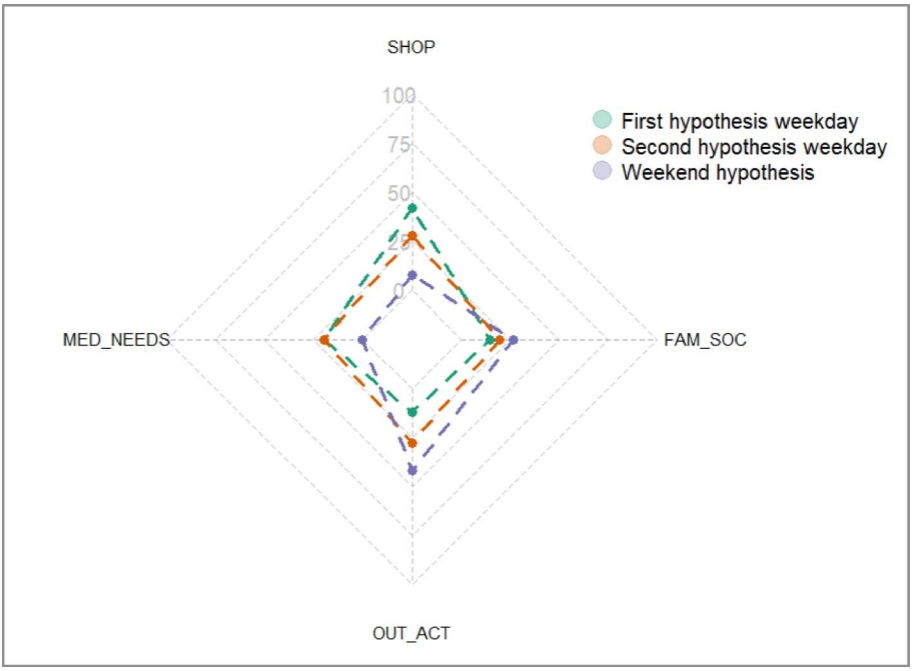

Fig. 2 Main stated reasons for movement

quantitative research, the random extraction of the sample takes place following the application of parameters, which guarantee all survey participants the same probability of being drawn. The risk of sampling error is therefore contained, providing a better quality of output. Particularly in the case of the present research, probability sampling was performed using stratification by gender and age segments: 65–69 years, 70–74 years, 75–79 years and over 80 years.

Based on the identification of the significant characteristics of the target following the research needs, the total population is divided into sub-groups, which are called 'strata'. Starting from them, the percentage of the citizens to be interviewed is calculated for each subgroup.

The choice of aggregating the sample by age group aimed at preserving the distinct characteristics and needs of movement in the different stages of old age (Burlando et al. 2021; Currie and Delbosc 2010; Haustein 2012).

The survey area - coinciding with the SilverBus pilot area - was located in the two neighbourhoods which presents the large population density of the elderly located nearby to the urban context of the city of Genoa.

Given the specificities of the interview target, the CATI (computer-assisted telephone interview) methodology was adopted, in order to allow greater control over the quality of questionnaire drafting with elder but also to achieve a more complete stratification. In order to limit the risk of dropouts from interviewees, the questionnaires were preceded by information calls from the interviewers, who scheduled the interviews in accordance with respondents' availability.

A direct communication channel was also provided with the Department of Economics and the company AMT S.p.A. in order to reassure participants about the nature of the surveys. Considering the strategy adopted towards the interview target group, a response rate of 67% of those approached was obtained.

Exploiting the generic lists of telephone landline numbers, where a higher response rate is observable for the age segment targeted, a total of 2.500 contacts were extracted from the phone book, equally divided between the two districts. Out of the overall contacts collected, 70% represented the over-65s. At the conclusion of the campaign, 250 valid interviews were used based on a stratification by gender and four age segments representative of the demographics of Genoa, that better express the heterogeneity within the elderly segment: 65–69 years, 70–74 years, 75–79 years and over 80 years. In Table 2, the demography of the city of Genoa and the main demographic characteristics of the sample collected with the distribution of respondents within the two districts are presented.

The demographic structure of the sample is highly consistent with that of the elderly population of Genoa. Gender distribution is nearly identical (female: 59.2% in the sample vs. 59% in the population), and the proportions across the main age brackets are also closely aligned (e.g., age 65–69: 22% in both; age≥80: 36% in both). These similarities indicate that the sample is demographically representative and that the results can be reasonably generalized to the elderly population of the city.

Pre-trial validation: assessing the willingness of using an urban mobility service for elderly

To investigate which factor influences the elderly's willingness to use a service like Silver-Bus, a binary logistic regression model was constructed.

Logistic regression, which belongs to the family of supervised machine learning, allows the evaluation of the role of a set of predictors (independent variables) in the probability of an event expressed by a dichotomous dependent variable occurring. The technique is widely used in the literature for assessing a user's willingness to use a service or incur a cost as part of public transport policy evaluation and design (Morfoulaki et al. 2010; Haustein 2012;

Table 2 Demography of the City of Genoa (Italy) and main characteristics of the sample drawn from the survey of two neighboring districts

Characteristics of Genoa	%	Characteristics of the sample	Frequency	%
Sex (SEX)		Sex (SEX)		
Female	59	Female	148	59.2
Male	41	Male	102	40.8
Total	100	Total	250	100
Age (AGE)		Age (AGE)		
65–69 (1)	22	65–69 (1)	55	22
70–74 (2)	23	70–74 (2)	58	22.3
75–79 (3)	19	75–79 (3)	47	18.8
>80 (4)	36	>80 (4)	90	36
Total	100	Total	250	100
		District (DIS)		
		DIS_A	156	62.4
		DIS_B	94	37.6
		Total	250	100

Source: Istituto Nazionale di Statistica (Istat).

Wong et al. 2018; Mariotti et al. 2021; Burlando et al. 2022). The main advantages include its effectiveness as a predictive model of event occurrence and the possibility of employing it for dichotomous and categorical variables, as well as its interpretive simplicity through the study of odds ratios (ORs).

From a mathematical standpoint, the general formula is presented below.

$$Logit\left(\mathbb{P}\left(Y=1\right)\right)=\ln\left(\frac{\mathbb{P}\left(Y=1\right)|X|}{1-\left(\mathbb{P}\left(Y=1\right)|X|\right)}\right)=\alpha+\sum{}_{i}{}^{\beta}{}_{i}\ \left(X_{i}\right)+\epsilon$$

Odds Ratios (Exp (β)) express the approximation of the relative risk by assessing the direction and strength of the link between the variables. It is described as the ratio of the event's odds (i.e., the probability of the event divided by its complement) in the presence and absence of a specific condition X (independent variable) or, in the case of an independent non-dichotomous variable, in the presence of a unitary variation in this condition. In this specific case, interest in the use of an alternative service to urban public transport and exclusive to users over the age of 65 was given as the target variable (Y), expressed as a dichotomous variable for which in operationalization the value "1" was given to interest and willingness to use, and the value "0" in case of the absence of it. Based on the literature review and the information gathered during the survey campaign, the regression model was constructed according to nine components (Table 3).

From a content interpretation, the age class was used as a control variable. The other eight variables are to be regarded as independent variables, which in turn can be categorized into car use, reason of movement, travel habits, and digital skills. The set of independent variables was dichotomized by reclassifying the set of responses into a binary logic (Table 4).

The logistic regression model demonstrates an overall acceptable fit. The likelihood ratio test ($G^2 = 33.20$, $p < 0.001$) confirms that the full model significantly improves upon the null model. McFadden's pseudo-R^2 is 0.096 and Nagelkerke's R^2 is 0.166 values that, although modest, are consistent with expectations for behavioral data where individual variability is high and not fully explainable.

Beyond overall model fit, several individual predictors emerge as statistically significant. Specifically, LTP_AUT and APP_USE show strong significance ($p < 0.01$), while MOR_RET is also significant ($p < 0.05$). These results indicate meaningful relationships with the likelihood of use and support the theoretical relevance of these factors within the context of the study.

Post-trial validation: satisfaction survey

The post-trial satisfaction survey aimed to assess user contentment and identify the strengths and weaknesses of the SilverBus service. Employing a methodology consistent with the pre-experimentation survey, the questionnaire was administered to actual service users. After stratifying and cleaning the sample, 127 valid responses were obtained.

The descriptive analysis of the main socio-demographic variables investigated (Table 2) shows that the sample's education rate is mainly concentrated on the level indicated by the achievement observed. Of the respondents, 46% were employed in the private sector and 33% in the public sector.

Table 3 Definition and operationalization of dependent, independent and control variables

Indicator	COD.	Operationalisation
Dependent component		
Willingness to use a service like SilverBus	WILL_USE	0 = no; 1 = yes
Independent components		
Autonomy in LPT use	LTP_AUT	Dummy variable: 1 = 6 to 10 score; 0 otherwise
Possession of valid car license	DRV_LIC	Dummy variable: 1 = valid car licence; 0 otherwise
Car use for travel	CAR_USE	Dummy variable: 1 = ≥ 5 travel (to-and-from = 2 travel); 0 otherwise
Reason for movement: medical or health needs	MED_NEC	Dummy variable: 1 = Reason for movement: medical or health needs; 0 otherwise
Reason for movement: outdoor activities	OUT_ACT	Dummy variable: 1 = Reason for movement: outdoor activities; 0 otherwise
Travel schedule: leaving in the morning (7:00 a.m. to 12:00 p.m.)	MOR_LEA	Dummy variable: 1 = leaving in the morning (7:00 a.m.-12:00 p.m.); 0 otherwise
Travel schedule: returning in the morning (7:00 a.m. to 12:00 p.m.)	MOR_RET	Dummy variable: 1 = returning in the morning (7:00 a.m.-12:00 p.m.); 0 otherwise
Using APPs to travel	APP_USE	0 = no; 1 = yes
Control variable		
Age class	YOUNG_ELD	Dummy variable: 1 = 65–74 years; 0 otherwise

Source: Authors' own elaboration.

Regarding the statistics on the ownership and use of a private vehicle for travel, 45% of the respondents declared to own a private vehicle (car, motorcycle), with a predominance of the "young elderly" (under 74 years) at 65%. Conversely, a lower percentage of the elderly claim to possess a valid driving licence (44%), most of whom are under 75 years old (70%). It is interesting to note that all individuals who reported never having held a driving licence are female.

The 40% of respondents mainly use private cars weekly, while 9% use them daily and 39% never use them at all.

However, 41% of respondents declare that they use the car exclusively as a passenger, indicating less independence in their travel and greater potential for autonomy with alternative modes of transport that offer flexibility.

Table 4 Logistic regression predicting likelihood of the willingness to use of SilverBus based on age, modes of movement, reason of movement, travel habits, and digital skills

	β	S.E.	z-value	*p*-value	Pr(>Chi)	Exp(β)	95% CI for Exp(β)	
							Lower	Upper
Age								
YOUNG_ELD	0.608	0.327	1.859	0.063	0.1518	1.84	0.97	3.49
Modes of movement								
LTP_AUT	0.813	0.381	2.136	0.033	0.0009	2.26	1.07	4.76
DRV_LIC	0.214	0.355	0.604	0.546	0.2163	1.24	0.62	2.49
CAR_USE	0.937	0.951	0.985	0.324	0.2892	2.55	0.40	16.49
Reason of movement								
MED_NEC	0.058	0.345	0.170	0.865	0.9187	1.06	0.54	2.09
OUT_ACT	0.395	0.486	0.814	0.415	0.2453	1.49	0.57	3.85
Travel habits								
MOR_LEA	1.256	0.643	1.953	0.050	0.2401	3.51	1	12.38
MOR_RET	-0.763	0.444	-1.719	0.085	0.0341	0.47	0.20	1.11
Digital skills								
APP_USE	0.914	0.437	2.088	0.036	0.0013	2.49	1.06	5.88

Results & discussion

From the results obtained due to the regression model set-up, statistical significance on the willingness to use the service is obtained for only three out of nine predictors as evidenced in Table 5.

The positive influence on the likelihood of using a SilverBus-type service is a more than sufficient level of autonomy in the use of local public transport (LTP_AUT, Exp(β)=2.26 and p-value=0.063).

In addition to travel autonomy, competence in the use of applications for the planning and enjoyment of LPT travel, reported by APP_USE (Exp(β)=2.49 and p-value=0.036), also appears to be crucial. This is a result that, from a policy perspective, emphasizes the still central issue related to the dissemination of digital skills within the population. If digital illiteracy is related to age, it could represent a potential barrier to mobility in the over-65 population, increasing its vulnerability to social exclusion and poor quality of life, as seen in the literature review (Bond et al. 2017).

Lastly, the remaining statistically significant predictor provides valuable information from the point of view of service design. When investigating travel habits, travel starting in the morning time segments assume greater significance (MOR_LEA, Exp(β)=3.51 and p-value=0.05). Assuming the result would be confirmed by the pilot, the service could be rethought as a morning-only solution, intervening both as an AA policy for the over-65s and as a means of relieving congestion on morning LPT lines, as well as containing the costs associated with a service that also covers the afternoon and evening hours.

As far as the age group is concerned, YOUNG_ELD does not represent a significant driver in the willingness to use the service. However, this information can be interpreted positively since it does not limit the potential users to a single age segment but opens to the entire over-65 community. A further interesting result is given by the predictors referring to CAR_USE and DRV_LIC.

Table 5 Main descriptive analysis of satisfaction survey sample categorised by sex and age class

Variables	Total Count	Share	% by sex		% by age class			
					Young Elder		Old Elder	
			Female	Male	65–69 y/o	70–74 y/o	75–79 y/o	Over 80 y/o
Educational background								
Primary school diploma	15	12%	60%	40%	13%	13%	7%	67%
Lower secondary scho42qol diploma or start-up	33	26%	55%	45%	9%	15%	33%	42%
High school diploma	70	55%	61%	39%	27%	29%	19%	26%
University degree, postgraduate qualification	9	7%	44%	56%	33%	33%	11%	22%
Total	127	100%						
Professional condition (pre-retirement or current)								
Homemaker	17	13%	100%	0%	18%	12%	12%	59%
Employed, self-employed	5	4%	100%	0%	0%	20%	40%	40%
Employed, private sector employee	59	46%	53%	47%	22%	25%	22%	31%
Employed, public sector employee	42	33%	48%	52%	26%	29%	14%	31%
Employed, freelancer	4	3%	25%	75%	0%	0%	75%	25%
Total	127	100%	58%	42%	21%	24%	20%	35%
Households dimension								
1	32	25%	81%	19%	13%	16%	25%	47%
2	84	66%	49%	51%	23%	27%	18%	32%
>3	11	9%	64%	36%	36%	18%	27%	18%
Total	127	100%	58%	42%	21%	24%	20%	35%
Ownership of a private vehicle								
Yes	70	55%	77%	23%	11%	17%	24%	47%
Valid driver's licence								
No, never had	36	28%	100%	0%	8%	19%	25%	47%
Licence expired	35	28%	57%	43%	11%	11%	26%	51%
Yes, still valid	56	44%	32%	68%	36%	34%	14%	16%
Total	127	100%	58%	42%	21%	24%	20%	35%
Frequency of private vehicle use								
Every day	11	9%	36%	64%	73%	27%	0%	0%
Weekly	51	40%	47%	53%	22%	31%	22%	25%
Monthly	12	9%	67%	33%	0%	25%	25%	50%
A few times a year	4	3%	75%	25%	25%	25%	25%	25%
Never	49	39%	71%	29%	14%	14%	22%	49%
Total	127	100%	58%	42%	21%	24%	20%	35%
Modes of use of private vehicles								
Driver	34	44%	15%	85%	41%	26%	18%	15%
Driver and passenger	12	15%	75%	25%	33%	33%	8%	25%
Passenger	32	41%	78%	22%	6%	31%	25%	38%
Total	78	100%	50%	50%	26%	29%	19%	26%

The non-significance shown by the regression model could be interpreted considering the pre-trial phase of the service, which fails to compete with an established modal preference for private car use by the elderly (Brown et al., 2018). Only 35% of the respondents claim to have a valid driving licence (54% of them are women and the 74% are young elders) and 62% use their car as a means of transport daily.

Interventions that lead a shift from private vehicles to collective transportation modes represent significant drivers of AA's transportation policies. For this age group, it depends on mobility pattern, often unaccountable to motivations that would allow a systematization based on days or time slots. Once the determinants of service use had been identified, a descriptive analysis was conducted of the information relating exclusively to those respondents who openly declared an interest in a service like SilverBus, equal to 55% of the interviewees. A relevant result considering that the survey preceding the pilot's implementation.

From a socio-demographic viewpoint, there is no difference in terms of stated age, in contrast to the gender component where there is a higher incidence of women (63.5%). Results show on average medium to elevated levels of autonomy in the elderly population regarding both walking and using public transport, with around 80% of respondents expressing a level of autonomy between 6 and 10 on a scale of ten. From this result emerges an aspect of continuity with recent literature, according to which the concept of old age has taken on a different dimension than in the past, thanks to healthier lifestyles that allow greater activity and mobility in the elderly population as previously stated. A further element confirming recent research findings is the importance given by seniors to the user experience as opposed to the monetary cost of the service (Burlando et al. 2022). Surveying the perceived relevance of a series of aspects characteristic of traditional public transport services (Table 6), respondents were asked to quantify them on a scale of 0 to 10 (totally irrelevant/absolutely relevant).

Frequency percentage calculated based on the ratings given by potential SilverBus users concerning LPT service characteristics assessed on a scale of importance from 0 to 10.

In addition, while detecting the preference prior to the actual testing of the service, 79% said they would be willing to continue to use SilverBus against the payment of the service if it was confirmed at the end of the free trial (16% of whom regardless of the price set). In order to support the design of the pilot, main motivations of movement by the over-65s were also traced, distinguishing between two hypotheses of weekday travel and one for the weekend.

As shown in Fig. 2, which reports the four most significant reasons for movement, no strong polarisation of the respondents with respect to one or more answers emerges. The non-significance of the reasons for movement revealed by the logistic regression model is therefore confirmed.

At this stage, travel for shopping (SHOP) and outdoor activities (OUT_ACT) prevail as weekday motivations.

Table 6 Assessment of relevance of LPT service user experiences characteristics

Characteristics	≤6	7–8	9–10
Comfort on board	1%	32%	67%
Security on board	3%	25%	72%
Accessibility	4%	23%	73%
Crowding of the vehicle	6%	28%	67%
Unimodality of the travel	3%	37%	61%

Concerning the weekend, there is a greater preference for travel for outdoor activities and the total absence of those for medical needs (MED_NEEDS).

Upon analysing the results obtained in the post-experimentation survey, a shift in the actual motivation for using the service is observed. This is evidenced by a 27% increase (49% in total) in those who prefer to use the service for health and medical purposes travel, with 52% of them being over 80 years old. In the pre-trial hypothesis, 46% of respondents stated a preference for 'shopping' as their main motivation. However, at the end of the six-month trial, only 26% of respondents stated that they preferred using SilverBus for this purpose. This preference was most common among those aged 75–79, with an equal distribution between genders.

The results obtained in the two survey campaigns can be compared by stratifying the samples based on the same criteria. This variation in preferences highlights the importance given to the double validation and experimentation of public transport services (Fig. 3). In this case, identifying hospital and health poles as the main points of interest provides data to support public decision-makers in optimizing service routes and public funds expenditure. The percentage of respondents who claim to use SilverBus for recreational or motor activities remains low.

Figure 4 shows another example of the analysis of time slots of use. The preliminary investigation revealed a strong imbalance in favour of travel in the morning confirmed by

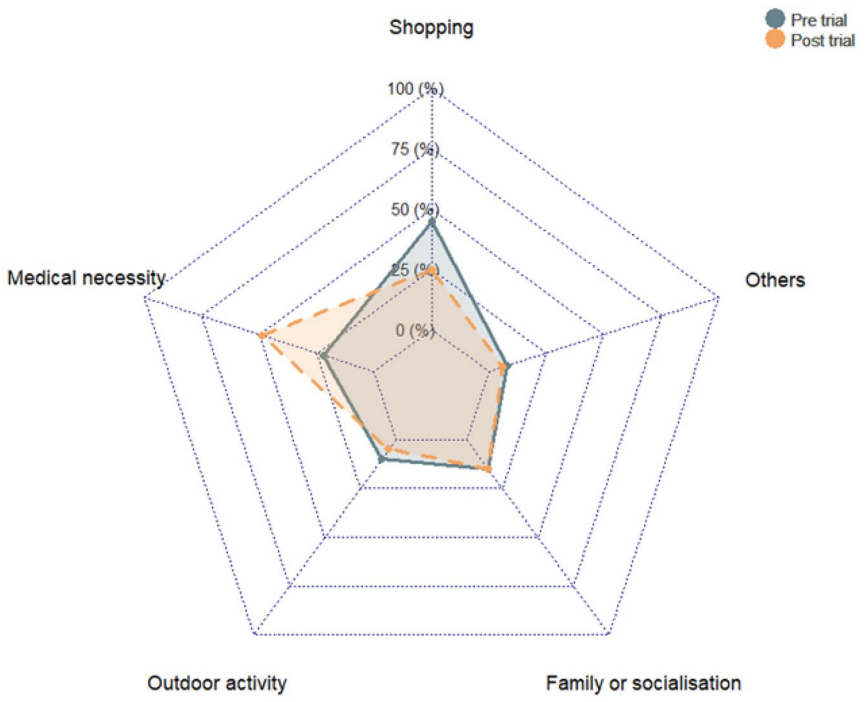

Fig. 3 Comparison between pre and post-trial main reason of movement

the predictive model. Cross-referencing this information with data collected from the service booking system, although less significant, confirms the higher concentration of travel requests in the morning hours, as declared before the experimentation. On the other hand, the use of the SilverBus in the evening hours were much higher than users had been expecting in the pre-trial phase.

Compared to the main travel modes used before the introduction of SilverBus, a significant segment of respondents said they had reduced the use of traditional LTP service and private vehicles (59% for each).

In the following section, the results of the satisfaction questionnaire comparing SilverBus and traditional LPT are presented. A set of eight primary satisfaction variables were categorised into two dimensions: one related to comfort features and the other focused on the user experience. These variables include accessibility to the vehicle, cleanliness of the vehicle, comfort on board, overcrowding of the vehicle, driver professionalism and attention to driving, helpfulness and kindness of on-board staff, perceived security on board, and safety during vehicle movement. The aim of replicating the set of questions is to compare the user experience of an innovative service, SilverBus, with the classic service provided in the local area. This provides additional information for validating the trial and researching pre-existing criticalities identified by the target group. The survey collected respondents' opinions using Likert scales with a base-5 rating system, assigning higher scores to indicate greater satisfaction. The results were graphically processed and presented below.

In terms of comfort (Fig. 5), the SilverBus prototype received a higher average score of 4.9/5 compared to the traditional transport service's average score of 2.5.

On the other hand, the evaluation of the traditional LTP service is different. There are worse performances regarding the assessments of the crowdedness of the vehicle and the general comfort perceived on board. As a result, over 50% of the passengers are dissatisfied (<3/5).

From this perspective, SilverBus can better meet the specific needs of its passengers. The on-demand nature of the service and absence of standing seats in the vehicle ensure greater comfort and less overcrowding. Additionally, the choice of vehicle accommodates accessibility needs, which tend to increase with age, especially during boarding and disembarking.

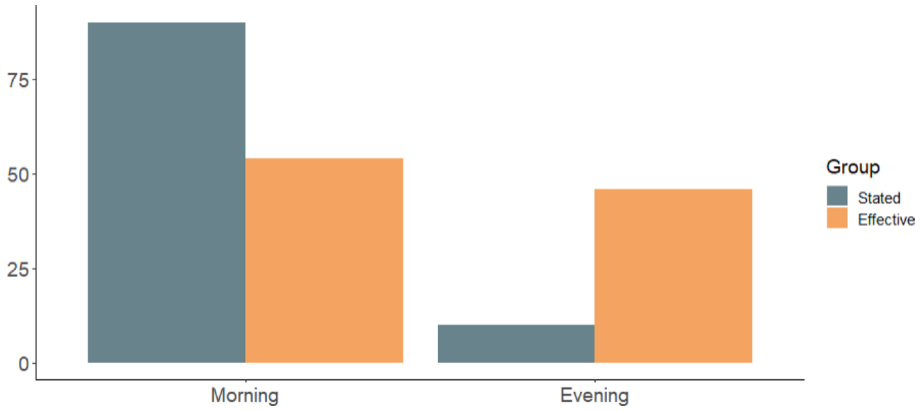

Fig. 4 Comparison of percentage of pre- and post-trial travel time preferences in the use of SilverBus

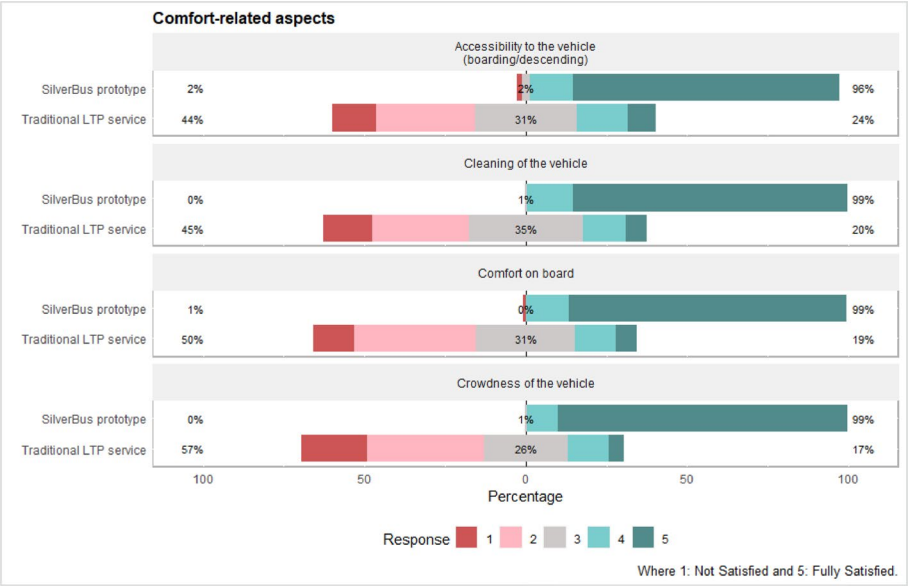

Fig. 5 Comparison of satisfaction ratings of transport features: Silverbus vs. traditional LPT about comfort

Regarding the user experience (Fig. 6), the evaluation of SilverBus is heavily balanced with 100% positive ratings (>3/5) and a significant number of users giving a score of 5/5 for each variable.

The variables in this dimension represent the aspects that have the greatest impact on the user experience, as identified during preliminary investigations conducted on the over-65 population.

Regarding the traditional LPT, there is a higher percentage of neutral evaluations (=3/5), indicating no significant polarization in the users' scores.

Turning to the evaluation of the booking and information system (Fig. 6), users highly appreciate the provision of information, both digital and otherwise, on how to use the service. Approximately 90% of the respondents reported a satisfaction level of 4/5 or higher, with a well-distributed response rate among young (46%) and elderly (54%) participants. However, the lowest ratings were mainly concentrated among those over 80 years old.

The availability of the service schedule also received positive feedback (77% rated it 4/5 or higher) during the 6-month trial period, covering morning, afternoon, and evening hours on both weekdays and weekends.

The level of satisfaction with the acceptance of requests during the booking phase is generally positive but lower than ideal, with only 30% of ratings being 3/5 or lower and 70% being 4/5 or higher. However, once the service is used, customers consistently rate the punctuality of the service highly in relation to the booking instructions (Fig. 7).

It should also be noted that, as can be seen from the analysis of the aggregated data derived from the service booking system, over the months there has been a gradual substitution within the booking method in favour of the mobile application (Fig. 8), even though, from the interviews conducted, 65% of respondents state that their main use is the call cen-

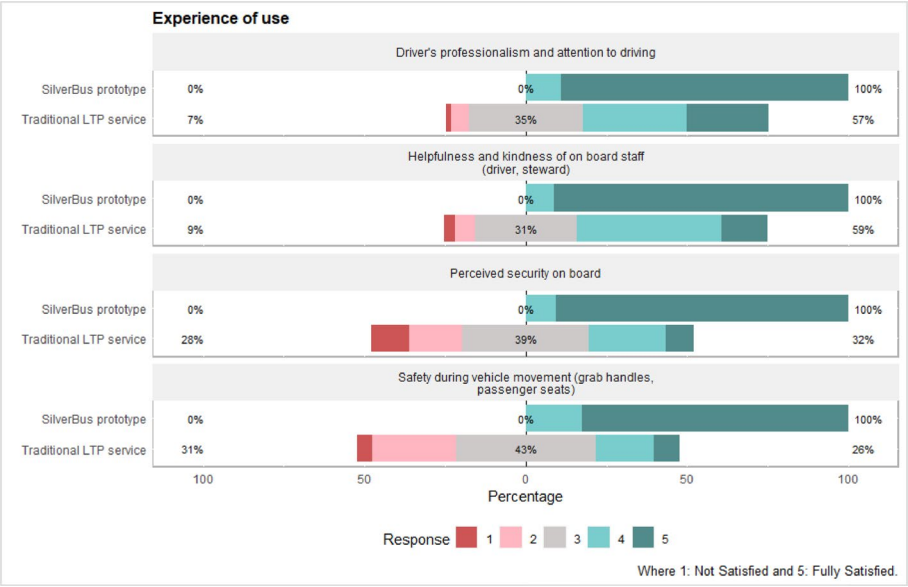

Fig. 6 Comparison of satisfaction ratings of transport features: Silverbus vs. traditional LPT about user experience

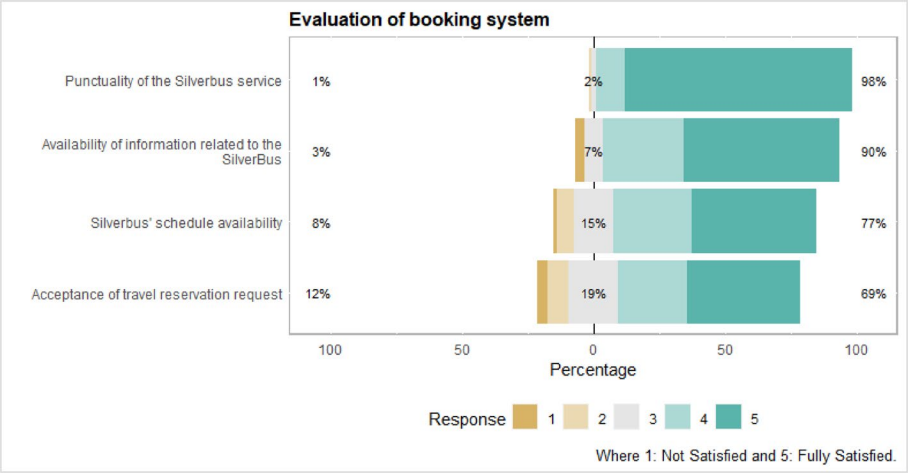

Fig. 7 Comparison of satisfaction ratings of transport features: Silverbus vs. traditional LPT about booking system

tre. The count excludes extemporary users (without reservation), admitted in the early stage of the trial, if seats were available and age requirements fulfilled.

In addition to satisfaction and usability, the findings also suggest signs of behavioural adaptation. While the second questionnaire did not explicitly ask about modal shift, several responses provide indirect evidence of such change. Notably, 56% of respondents reported

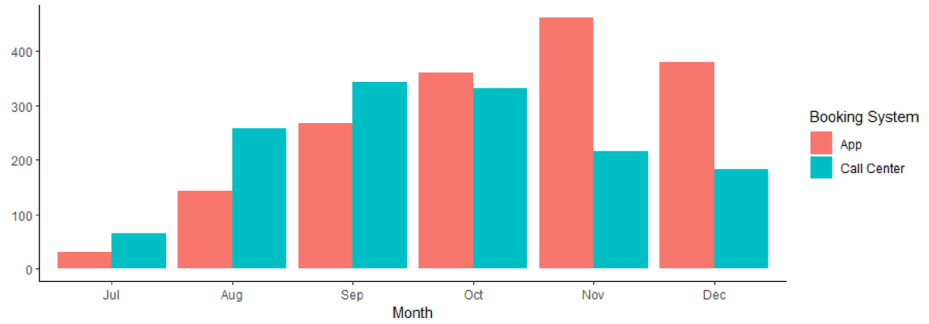

Fig. 8 SilverBus service booking method trends

a decrease in the use of both traditional public transport and private vehicles following the trial period. Furthermore, 47% stated they do not use a private vehicle at all, and among those who do, 49% act solely as passengers. These figures point to limited autonomous access to private transport and a tendency to adopt SilverBus as a viable and appreciated alternative. In addition, 45% of users reported an increased use of the service during the trial, indicating growing familiarity and trust.

Importantly, when asked how the permanent suspension of the service would affect them, many respondents expressed a strong emotional and practical dependence on it. The average rating for the statement "It would upset me not to use the service anymore" was 4.1 on a 5-point scale, while the statement "I would travel with greater difficulty" scored 3.0. These results reinforce the perception that SilverBus is not just a complementary service, but a relevant enabler of independent and dignified mobility.

In conclusion, in addition to survey-based findings, objective usage data were obtained from the service provider's operational platform, which tracks all bookings and completed rides. During the six-month trial, 3,540 rides were completed by 333 registered users, yielding an average of 10.6 trips per user. Usage increased steadily, with an average monthly growth rate in ride volume was approximately 36% with a modest seasonal decline in December, indicating strong and consistent adoption over time,

Structured booking channels (mobile app and call center) accounted for 66% of total reservations, indicating progressive user adoption and system familiarity. The cancellation rate was extremely low (2.4%), suggesting that once booked, trips were reliably executed. These objective indicators confirm that SilverBus was consistently used and perceived as a dependable transport solution by a growing number of users, validating its operational viability beyond self-reported satisfaction.

The present study demonstrates the replicability of the SilverBus model in other urban contexts characterised by differing socio-demographic characteristics. The methodological approach adopted, based on a pre- and post-experimental analysis, allows for the adaptation of the service to the specific needs of the local population, regardless of population density or demographic structure. Furthermore, the combination of digital and traditional booking tools ensures high accessibility, making the service scalable in areas with different levels of technological literacy. The DRT model's adaptability ensures the optimisation of resources according to local demand, thus ensuring its effectiveness in both densely populated urban areas and areas with greater housing dispersion. The study's findings demonstrate that a mobility service tailored to the elderly population can enhance quality of life and promote

social inclusion, providing a valuable reference point for other cities considering the implementation of similar solutions.

Limitations

While the findings of this study provide valuable insights into the factors influencing the willingness to use SilverBus among the elderly, some methodological limitations must be acknowledged to better contextualize these results.

First, despite using a probabilistic sampling approach with stratification by age and gender, the sample may not fully capture the heterogeneity of Genoa's over-65 population—particularly among subgroups with limited telephone accessibility, lower digital literacy, or specific mobility impairments. This potential sampling bias could affect the generalizability of the findings also out of the case study area. Additionally, it is important to consider the potential bias related to the self-selection of the second sample (post-trial survey), as it was drawn exclusively from the service's active users. This could lead to an overrepresentation of individuals with particularly favourable experiences, potentially distorting the results.

Secondly, the six-month duration of the pilot trial may be too short to capture long-term behavioral changes or adaptations in service usage, as it could fails to account for seasonal variations that could affect modal choices and travel motivations among the target population.

Third, while the binary logistic regression model identified key predictors, it may not account for other influential variables such as detailed health status, socioeconomic conditions, or the presence of familial or community support systems, all of which can significantly impact mobility behaviors in elderly populations.

Finally, given that this study focuses on a single urban context, the extent to which these findings are transferable to other cities with different demographic, infrastructural, or socioeconomic characteristics remains uncertain. Future research should address these limitations by employing larger, more diverse samples, incorporating additional predictive variables, extending the observation period, and exploring the impact of cost introduction on user behaviour.

Conclusions

This study underscores the critical importance of conducting both pre- and post-implementation validation when developing innovative transportation policies aimed at active aging (AA) paradigms. By employing a comprehensive methodology that includes preliminary surveys and subsequent analyses, decision-makers can ensure the effective allocation of public funds and the alignment of services with the actual needs of the elderly population.

Utilizing the metropolitan city of Genoa as a case study—a city notable for its significant demographic aging at both Italian and European levels (Burlando et al. 2022)—the research focused on the SilverBus project, an exclusive demand-responsive public transport service tailored for citizens over 65. Initial phases involved constructing a predictive binary logistic regression model to assess potential user interest, with variables such as autonomy in using

public transport, use of digital applications for travel planning, and morning travel preferences emerging as significant predictors.

However, the post-experimentation analysis revealed shifts in user behaviour and motivations. While the preference for morning usage remained, there was a notable increase in evening utilization, primarily associated with cultural and recreational activities. Additionally, travel for medical and health-related purposes became more prominent than initially anticipated. These findings highlight the necessity of adapting services to evolving user needs, which may differ from pre-trial hypotheses due to increased user awareness and the introduction of previously unavailable services.

The study also emphasizes the importance of inclusive service design elements, such as offering both digital and traditional booking channels and providing on-board stewards. These features not only promote digital literacy among the elderly but also ensure accessibility for non-digitally literate users, thereby broadening the potential user base.

In conclusion, the SilverBus case study illustrates that hypotheses formulated during the preliminary phase may evolve based on ex-post data analysis. This evolution underscores the need for adaptive service models that respond to the actual needs of users, ensuring the efficient use of public funds and the successful implementation of transportation policies inspired by active aging paradigms. Future research should continue to explore user preferences and behaviors through ongoing validation efforts, thereby refining service offerings to better meet the dynamic needs of the elderly population.

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Author contributions Credit StatementClaudia Burlando: Conceptualization, Investigation, Resources, Writing – Original Draft, Writing – Review and Editing, Supervision, Project Administration, Funding acquisition. Enrico Ivaldi: Conceptualization, Writing – Review and Editing, Supervision, Data Curation. Tiziano Pavanini: Conceptualization, Investigation, Resources, Writing – Original Draft, Writing – Review and Editing. Susanna Traversa: Methodology, Writing – Original Draft, Writing – Review and Editing, Data Curation.

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Declarations

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

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Authors and Affiliations

Claudia Burlando[1] · Enrico Ivaldi[2] · Tiziano Pavanini[3] · Susanna Traversa[4]

✉ Tiziano Pavanini
tizianopavanini22@gmail.com

Claudia Burlando
claudia.burlando@unige.it

Enrico Ivaldi
enrico.ivaldi@iulm.it

Susanna Traversa
traversa.su@gmail.com

[1] Department of Economics and Business and Italian Centre of Excellence in Logistics, Transport and Infrastructure (CIELI), University of Genoa, Via Francesco Vivaldi, 5, Genoa 16126, Italy

[2] Department of Humanities, IULM, Via Carlo Bo, 1, Milano 20143, Italy

[3] CIELI - Italian Centre of Excellence in Logistics, Transport and Infrastructure, University of Genoa, Via Francesco Vivaldi, 5, Genoa 16126, Italy

[4] CIELI - Italian Centre of Excellence in Logistics, Transport and Infrastructure, University of Genoa, Via Francesco Vivaldi, 5, Genoa 16126, Italy