

Perceived Neighborhood Environment and Changes in Walking for Transportation Among Older Adults: Findings from the EpiFloripa Aging Cohort

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Abstract

This study analyzed the effect of changes in neighborhood environment perception on transport walking among older adults in Florianópolis, Southern Brazil, over a decade. Using data from the EpiFloripa Aging Cohort (2009/2010) and its follow-ups in 2013/2014 and 2017/2019, we followed 737 adults aged ≥ 60 years (66.8% women). Perceived neighborhood environment was assessed with an adapted version of the Neighborhood Environment Walkability Scale (A-NEWS), and transport walking was measured with the International Physical Activity Questionnaire (IPAQ). Generalized Estimating Equations were used to examine the association between perceived environment and transport walking. Over ten years, positive perceptions of sidewalk quality declined from 66.7% to 40.4% ($\Delta = -26.3$ percentage points) and of nearby green spaces from 68.4% to 48.0% ($\Delta = -20.4$ percentage points), whereas perceptions of pedestrian crossings improved (63.7% to 69.9%), and drivers' respect for these crossings rose (62.5% to 68.2%) and then fell (57.3%). Half of the participants (50%; 95%CI: 46.3–53.6) maintained ≥ 10 minutes per week of transport walking throughout the decade. Each unit increase in positive neighborhood environment perception was associated with 8% greater odds of engaging in ≥ 10 minutes of transport walking per week (OR = 1.08; 95%CI: 1.03–1.12; $p < 0.001$). More favorable perceptions of the neighborhood environment were therefore associated with the maintenance of transport walking throughout aging, highlighting the relevance of urban conditions related to accessibility, safety, and the quality of public spaces in supporting active mobility among older adults.

1. Introduction

Population aging is becoming one of the major contemporary global challenges, not because of the phenomenon itself, but because of the accelerated rate at which it is occurring¹. Aging alters individuals' functional capacities and changes how they perceive their surrounding environment, directly affecting walking for transportation and transportation-related walking patterns among older adults. The number of older adults is estimated to double over the coming decades, increasing from approximately 1 billion in 2019 to 2.1 billion by 2050². In Brazil, this process is occurring at a similarly rapid pace: the proportion of people aged 60 years or older nearly doubled between 2000 and 2023, increasing from 8.7% to 15.6% of the population, and projections indicate that older adults will account for approximately 37.8% of the Brazilian population by 2070³. This scenario poses growing challenges for public health and urban planning, particularly in contexts characterized by socio-spatial inequalities^{4,5}. In this context, the ecological model emphasizes that health behaviors and outcomes result from interactions among individual, interpersonal, environmental, and policy-level factors and has been widely used to understand the relationship between the built environment, physical activity, and active aging^{6,7}.

Walking stands out as the most prevalent physical activity behavior among older adults and a central component of active aging. Although the literature has prioritized leisure-time walking, transportation walking represents an accessible, functional activity integrated into daily life⁸. This type of activity has been associated with the maintenance of functional capacity, improved mobility, greater autonomy, and

social participation⁹. Recent evidence indicates that even low levels of transportation walking are associated with a reduced risk of mortality among adults aged 70 years or older¹⁰. Furthermore, in less socioeconomically advantaged settings, walking often constitutes the primary means of daily transportation, reinforcing its relevance to public health¹¹.

Transportation walking among older adults is strongly influenced by characteristics of the urban environment, particularly perceptions of the neighborhood environment^{12–14}. In this regard, environments perceived as unsafe, characterized by heavy traffic, inadequate infrastructure, or a lack of public spaces tend to discourage utilitarian walking and promote sedentary behaviors¹⁵. Conversely, neighborhoods perceived as safe and accessible, with adequate pedestrian infrastructure and green spaces, are associated with greater engagement in transportation walking and greater social participation among older adults¹⁶.

Despite growing recognition of the influence of the urban environment on walking in later life, important gaps remain in the literature. Most studies investigating this relationship rely on cross-sectional designs, limiting temporal inferences regarding how changes in environmental conditions affect behavior over time¹⁷. Furthermore, the evidence is predominantly concentrated in high-income countries^{18,19}, restricting our understanding of this dynamic in contexts characterized by greater socio-spatial inequality. In particular, Latin American contexts remain underrepresented, despite experiencing both rapid population aging and pronounced urban inequalities, which limits the direct transferability of available evidence to these settings⁹.

Against this backdrop, Brazilian cities offer important opportunities for research, as they combine rapid population aging with pronounced urban inequalities²⁰. Although the capital city of Florianópolis has a high Human Development Index (0.847)²¹ and is located in an upper-middle-income country²², it is characterized by substantial socio-spatial heterogeneity. This context may differentially influence perceptions of the neighborhood environment and mobility patterns among older adults. Investigating these relationships over time may advance our understanding of the dynamic effects of perceived environmental conditions on transportation walking, particularly in middle-income settings.

Understanding this relationship requires viewing the neighborhood environment not as a set of isolated attributes, but as an interdependent system in which different perceived characteristics interact to shape transportation behavior. From the perspective of ecological models, which emphasize the interaction between the perceived environment and individual behavior, we hypothesize that older adults who perceive more favorable environments are more likely to maintain transportation walking despite the functional losses associated with aging.

Therefore, this study aimed to analyze the effect of changes in perceptions of the neighborhood environment on transportation walking among older adults in Florianópolis over a decade.

2. Methods

2.1. Study design

This was a population-based, household-based longitudinal study using 10 years of follow-up data (2009–2019) from the EpiFloripa Older Adult Cohort Study (<https://epifloripaidoso.páginas.ufsc.br/sim#>), conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

The study was conducted in Florianópolis, Santa Catarina, Brazil, a city with a total area of 675.4 km², divided into 651 census tracts (603 urban and 48 rural)²³. According to the 2022 Demographic Census, the municipality had 537,211 inhabitants and a population density of 796.05 inhabitants/km², making it the state capital and the second most populous city in Santa Catarina^{20,24}. The city's rapid population aging and pronounced socio-spatial heterogeneity make it a relevant setting for investigating urban conditions that promote active mobility among older adults. The city is predominantly located on an island (97.2%) and has a moderate level of social inequality (0.50)^{21, 22, 25}.

2.2. Sample selection

The sample comprised older adults (≥ 60 years) who participated in all three waves (2009/2010, 2013/2014, and 2017/2019) of the EpiFloripa Older Adult Cohort Study. At baseline, a two-stage cluster sampling procedure was used, with census tracts serving as the primary sampling units and households as the secondary sampling units.

Initially, 420 urban census tracts were stratified according to deciles of household-head income. Subsequently, eight census tracts per decile were systematically selected, resulting in an initial sample of 1,702 participants. In the second wave, active tracing of eligible individuals was conducted, accounting for losses to follow-up, deaths, and refusals, resulting in 1,197 participants being interviewed. The third wave included only participants who had been followed longitudinally since baseline, totaling 743 individuals with information available from all three waves. Individuals of either sex, aged 60 years or older, and residing in the urban area of Florianópolis, Santa Catarina, were eligible for inclusion.

Institutionalized and bedridden older adults were excluded from the study. Face-to-face interviews were conducted in participants' homes by trained interviewers using a structured, computer-assisted questionnaire. Interview quality control was performed by administering a shortened questionnaire to 15% of participants, and Kappa values were considered satisfactory to ensure adequate data quality. Additional details on the methodological procedures of the EpiFloripa Older Adult Cohort Study can be found in previous publications^{26, 27}.

<< INSERT FIGURE 1 >>

2.3 Outcome

Walking for transportation during the seven days of a typical week was assessed using the extended version of the International Physical Activity Questionnaire (IPAQ), which has been validated for Brazilian older adults²⁸. Information was collected on the frequency (days/week) and duration (minutes/day) of walking for transportation. For analytical purposes, weekly time was calculated by summing moderate- and vigorous-intensity activities, accounting for the differential weighting of intensity: (moderate-intensity activity + [vigorous-intensity activity × 2]). The outcome was operationalized as a dichotomous variable, classifying participants as not engaged (no transportation-related activity) or engaged (≥ 10 minutes/week of transportation-related activity).

This classification was performed separately for each of the three waves, using the same criteria and cutoff point at all time points. Thus, the outcome was treated as a time-varying variable, allowing both the engagement status at each wave and changes over the follow-up period to be captured.

2.4 Exposure

Perceived neighborhood environment was assessed using the Neighborhood Environment Walkability Scale (NEWS), which had previously been translated and validated for adults and older adults in Brazil^{29, 30}. The instrument assesses characteristics related to neighborhood walkability, with the neighborhood defined as the area surrounding the residence that can be reached on foot in approximately 15 minutes.

In this study, 15 items with dichotomous response options (yes/no) were analyzed, following an approach previously used in the literature^{14, 31}. The items covered different dimensions of the built environment, including: (i) land use and access to destinations, such as the presence of shops, services, and leisure facilities, as well as ease of access to these locations; (ii) walking infrastructure, including the presence and quality of sidewalks, the availability of suitable crossing locations, and cycling infrastructure; (iii) street connectivity, considering the existence of alternative routes and connections between streets; (iv) aesthetic features, such as the presence of trees, shade, and environmental pleasantness; (v) traffic-related safety, including vehicle volume and speed; and (vi) crime-related safety, concerning perceived safety when walking in the neighborhood.

For each assessment wave, the 15 dichotomous items were summed to generate a positive perceived neighborhood environment score ranging from 0 to 15 points, with higher values indicating a more favorable perception of neighborhood walkability. This score was calculated independently for each of the three waves, allowing changes over the follow-up period to be characterized.

To describe temporal changes in perceived neighborhood environment, the absolute difference (Δ), in percentage points, between the proportion of positive perceptions in the first and final waves was calculated for both the total score and the individual items across the instrument's six dimensions. This measure made it possible to identify which built-environment characteristics showed the greatest variation over the decade analyzed.

2.5 Covariates

Sociodemographic and health characteristics were considered as covariates. Sociodemographic variables included sex (male or female), age group (60–69 years, 70–79 years, and ≥ 80 years), and educational attainment (0–4 years, 5–8 years, and ≥ 9 years of schooling).

Health conditions were assessed based on the number of self-reported morbidities, categorized as none or one morbidity, two to three morbidities, and more than three morbidities. Cognitive impairment was screened using the *Mini-Mental State Examination (MMSE)*, adopting the cutoff points proposed by Almeida³². Probable cognitive impairment was defined as scores < 19 points among individuals with no formal education and < 24 points among those with any level of education. This variable was treated dichotomously (presence/absence). Finally, depressive symptoms were screened using the *Geriatric Depression Scale (GDS)*, with the presence of symptoms defined as scores ≥ 6 points, as proposed by Almeida and Almeida³³. Morbidity, cognitive impairment, and depressive symptoms were treated as baseline confounding variables and included as adjustment variables, considering that they may temporally precede both longitudinal patterns of walking for transportation and changes in health conditions during follow-up.

2.6 Data analysis

Sample characteristics and the prevalence of the outcomes throughout follow-up were described using descriptive statistics, including absolute and relative frequencies and their respective 95% confidence intervals (95% CIs).

To assess the associations between walking for transportation and perceived neighborhood characteristics, a longitudinal analysis based on Generalized Estimating Equations (GEE) was used. GEE is an extension of Generalized Linear Models that accounts for within-individual correlation arising from repeated measurements over follow-up³⁴. In these models, both the outcome (walking for transportation, ≥ 10 minutes/week) and the exposure (perceived neighborhood environment score) were treated as time-varying variables, measured at each of the three waves, such that the estimates reflect the association between changes in perceived neighborhood environment and changes in walking for transportation over follow-up. The cutoff point of ≥ 10 minutes/week was adopted to capture engagement in walking for transportation over time, considering that even low levels of physical activity may be relevant among older adults.

With the inclusion of the time variable, the dataset was restructured from “wide” to “long” format, allowing repeated measurements to be appropriately modeled and within-individual missing data over follow-up to be handled. First, crude models were estimated, followed by adjusted models that included sociodemographic and health variables associated with the outcome in bivariate analyses. The resulting estimates represent population-averaged effects over the 10 years of follow-up in the EpiFloripa Older Adult Cohort Study. All analyses were performed using Stata version 13.0 (StataCorp LP, College Station, TX, USA).

2.7 Ethical considerations

The study was approved by the Research Ethics Committee of the Federal University of Santa Catarina under approval number 352/2008 at baseline (2009/2010), and under Certificate of Presentation for Ethical Consideration (CAAE) No. 16731313.0.0000.0121 for Wave 2 (2013/2014). Wave 3 (2017/2019) was approved under the same CAAE as Wave 2, with Amendment No. 1,957,977. All participants provided informed consent to participate in the study by signing the Informed Consent Form.

3. Results

Table 1 presents the characteristics of participants across the three waves. A total of 737 older adults were followed over a decade (2009–2019), the majority of whom were women (66.8%). At baseline, participants aged 60–69 years predominated (61.1%), whereas the proportion of older adults aged 70–79 years increased from 42.6% to 53.2% in subsequent waves, and the proportion aged 80 years or older increased markedly from 5.4% to 32.4%. A slight increase was observed in the proportion of participants with low educational attainment (0–4 years of schooling), from 40.7% to 41.3%, and most participants had lived in the same neighborhood for more than 10 years (87.5% at the end of the follow-up period). Regarding health conditions, the prevalence of three or more morbidities increased from 56.0% to 58.1%, with no significant changes in the levels of mild cognitive impairment (MCI) or depressive symptoms across waves.

<< INSERT TABLE 1 >>

After one decade of follow-up, the proportion of older adults with a positive perception of sidewalk quality decreased from 66.7% (95% CI: 62.7–70.5) in the first wave to 40.4% (95% CI: 36.0–44.0) in the third wave ($\Delta = -26.3$ percentage points). Similarly, the proportion reporting the presence of green areas near their residences decreased from 68.4% (95% CI: 64.9–71.7) to 48.0% (95% CI: 44.4–51.6) ($\Delta = -20.4$ percentage points). In contrast, the perceived presence of pedestrian crosswalks increased from 63.7% (95% CI: 60.2–67.1) in the first wave to 69.9% (95% CI: 66.4–73.1) in the third wave. The perception that drivers respect pedestrian crosswalks increased from 62.5% (95% CI: 58.0–66.8) in the first wave to 68.2% (95% CI: 64.0–72.2) in the second wave, but then decreased to 57.3% (95% CI: 53.6–60.8) in the third wave ($\Delta = -5.2$ percentage points).

Regarding the presence of bicycle lanes and walking spaces, the prevalence increased from 27.9% (95% CI: 24.7–31.2) in the first wave to 36.9% (95% CI: 33.5–40.5) in the third wave. In addition, the positive perception of the availability of parks and squares increased substantially, from 35.1% (95% CI: 31.7–38.6) in the first wave to 50.8% (95% CI: 47.2–54.4) in the third wave. Finally, the perception of sports events being held in neighborhoods increased from 21.1% (95% CI: 18.3–24.2) in the first wave to 30.5% (95% CI: 27.2–34.1) at the end of the follow-up period.

<< INSERT TABLE 2 >>

Regarding changes in the prevalence of walking for transportation, comparing baseline (2009/2010) with the final wave (2017/2019), 50% (95% CI: 46.3–53.6) of older adults maintained walking for at least 10

minutes per week despite the aging of the cohort. In contrast, 20% (95% CI: 17.0–22.8) stopped walking during the period, while 16% (95% CI: 13.7–19.0) remained inactive throughout the decade. Conversely, 14% (95% CI: 11.8–16.9) of the older adults who did not walk in 2009 began engaging in regular walking by 2019.

<< INSERT FIGURE 2 >>

A positive association was observed between perceived neighborhood environment and walking for transportation (≥ 10 minutes per week) among older adults (Table 3). In the adjusted analysis, each one-point increase in the positive perceived neighborhood environment score was associated with walking for transportation (OR: 1.08; 95% CI: 1.03–1.12; $p < 0.001$), representing 8% higher odds of this behavior over the study period (2009–2019).

<< INSERT TABLE 3 >>

4. Discussion

This study analyzed, over a decade, the effect of changes in perceived neighborhood environment on walking for transportation among older adults in Florianópolis, Santa Catarina, Brazil. Overall, the findings indicate that more positive perceptions of neighborhood environmental characteristics were associated with higher odds of engaging in walking for transportation over the 10-year period. In addition, the maintenance of this behavior by a substantial proportion of the cohort suggests that perceived environmental attributes may contribute to preserving active mobility throughout aging. Taken together, these findings reinforce the relevance of the urban context for promoting walking in later life.

Maintaining walking for transportation among nearly half of the participants over 10 years is a relevant finding, particularly given the increase in the proportion of individuals aged 80 years or older. This finding contrasts with evidence of declining mobility with aging^{35, 36}, suggesting that this process is not uniform. Studies indicate that favorable environmental characteristics contribute to sustaining active mobility^{17, 37, 38}. One possible explanation is that more accessible and safer environments reduce functional barriers and increase the feasibility of walking as a mode of transportation. These findings reinforce the importance of interventions such as sidewalk improvements, traffic safety measures, and proximity to destinations.

The analysis of transitions in walking for transportation showed that, in addition to maintaining the behavior, some participants stopped walking, whereas others adopted the behavior only by the third wave of the study. This pattern indicates that walking for transportation is a dynamic behavior during aging, subject to both discontinuation and adoption at later stages of life⁸. Evidence points to this dynamic nature, influenced by individual and contextual factors^{18, 39}. Late initiation of walking for transportation may be related to favorable changes in perceptions of the neighborhood environment^{37, 40}. This relationship suggests that walking for transportation is a potentially modifiable behavior, reinforcing

the importance of continuous strategies, particularly among individuals at risk of discontinuing the behavior or who have recently become inactive.

The results showed different directions in the perception of neighborhood environmental characteristics over follow-up. A deterioration was observed in structural aspects of walkability, such as sidewalk quality and the presence of green areas, which are frequently associated with walking^{17,18}. This reduction may contribute to discontinuation of the behavior, particularly in the context of functional aging. In contrast, improvements were observed in perceptions of traffic safety-related aspects, such as the presence of pedestrian crosswalks, as well as in the use of public spaces, with greater availability of places for walking. Drivers' respect for crosswalks followed a less consistent pattern, rising in the second wave and declining in the third. In this regard, studies have associated such improvements with active mobility policies and urban improvements^{11,41}. In Florianópolis specifically, the Sustainable Urban Mobility Plan for Greater Florianópolis (PLAMUS) and the municipal Urban Mobility Plan established the improvement of pedestrian and cycling infrastructure and sidewalk quality as priorities²⁴.

The improvements observed in traffic safety-related aspects may reflect recent investments in urban infrastructure and interventions aimed at pedestrian safety, including road improvements and active mobility measures implemented in Brazilian cities⁴². Conversely, the coexistence of improvements in safety and deterioration in structural attributes of walkability may reflect the uneven implementation of these interventions over time⁴³. This scenario reinforces the need for integrated approaches capable of combining basic infrastructure with actions aimed at safety and the activation of public spaces.

The positive association between perceived neighborhood environment and walking indicates that the interaction among different environmental attributes may influence this behavior. The combination of perceived conditions appears to influence the likelihood of walking in an integrated manner^{37,44}, and the longitudinal design indicates that changes over time are accompanied by changes in behavior. These findings are consistent with evidence from middle-income countries^{9,14}. One possible explanation is that the combination of favorable conditions may simultaneously reduce multiple barriers⁴⁵, suggesting that isolated interventions may have limited effects, whereas interventions that act in a coordinated manner may be more promising.

The high proportion of participants who had lived in the same neighborhood for more than a decade indicates a context of aging in place, in which attachment to the territory and familiarity with the neighborhood influence the relationship with the environment. Long-term residential stability has been associated with greater knowledge of the territory and more consistent use of available resources^{46,47}. Continuous exposure may increase sensitivity to environmental changes, facilitating their incorporation into daily routines^{37,48}. This context may influence how environmental changes are perceived and incorporated into mobility behavior. This suggests that urban interventions may have more relevant effects in contexts of greater residential stability.

The findings indicate that interventions in the urban environment, such as improvements to pedestrian infrastructure, traffic safety, and public spaces, are central to promoting and sustaining walking for transportation among older adults⁴⁹. Consistent with active aging, these actions contribute to maintaining mobility and functional autonomy and align with global agendas such as the Sustainable Development Goals^{17,50}. The findings also reinforce the need for integrated approaches and the participation of older adults in urban planning to increase the effectiveness and equity of interventions.

The interpretation of the findings should consider some limitations. The sample, composed of older adults living in a city in the Global South with a high Human Development Index and specific geographic characteristics, may limit the generalizability of the findings. Multicenter studies are therefore warranted to strengthen the evidence and expand external validity. The use of subjective measures may introduce information bias. Although a valid instrument widely used in studies involving older adults was employed, its accuracy may be lower for estimating specific intensities of physical activity, particularly vigorous-intensity activities, compared with objective measures such as accelerometers. Thus, future investigations may benefit from combining subjective and objective measures to provide a more comprehensive and accurate assessment of physical activity. In addition, the longitudinal design may be subject to survival bias, as loss to follow-up and mortality may result in increasingly selective samples over time, influencing the interpretation of the findings.

The strengths of this study include its population-based sample, 10-year longitudinal follow-up, and analysis of changes in perceived neighborhood environment and walking for transportation over time. The analytical approach allowed for a deeper understanding of the dynamics between the environment and mobility during aging, overcoming limitations frequently associated with cross-sectional studies. The findings strengthen the evidence on the association between perceived neighborhood environment and walking for transportation while highlighting the role of well-qualified urban contexts in promoting mobility, autonomy, and social participation among older adults. Taken together, this study contributes to advancing knowledge regarding the influence of the built environment on health and well-being in aging, particularly in urban contexts in the Global South.

5. Conclusion

In summary, the findings suggest that changes in perceived neighborhood environment are accompanied by the maintenance of walking for transportation throughout aging. Beyond individual factors, active mobility in later life appears to depend on urban conditions that promote accessibility, safety, and the effective use of public spaces. Thus, interventions aimed at improving the urban environment may constitute relevant strategies for promoting autonomy, mobility, and social participation among older adults.

Declarations

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Tables

Table I. Characteristics of participants in the EpiFloripa Aging Cohort Study. Florianópolis, Brazil, 2009/2019. (n = 737)

Variables	Follow-up (n = 737)					
	Wave 1 (2009/2010)		Wave 2 (2013/2014)		Wave 3 (2017/2019)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Sex						
Male	245	33.2 (29.9–36.7)	245	33.2 (29.9–36.7)	245	33.2 (29.9–36.7)
Female	492	66.8 (63.3–70.1)	492	66.8 (63.3–70.1)	492	66.8 (63.3–70.1)
Age group						
60 to 69 years	450	61.1 (57.5–64.5)	300	40.7 (37.2–44.3)	106	14.4 (12.0–17.1)
70 to 79 years	247	33.5 (30.2–37.0)	314	42.6 (39.1–46.2)	392	53.2 (49.6–56.8)
80 years or older	40	5.4 (4.0–7.3)	123	16.7 (14.2–19.6)	239	32.4 (29.1–35.9)
Schooling						
0 to 4 years	297	40.7 (37.2–44.3)	297	40.7 (37.2–44.3)	302	41.3 (37.8–44.9)
5 to 8 years	126	17.3 (14.7–20.2)	126	17.3 (14.7–20.2)	148	20.3 (17.5–23.3)
9 years or more	308	42.0 (38.5–45.7)	308	42.0 (38.5–45.7)	281	38.4 (35.0–42.0)
Morbidities						
None	57	7.7 (0.6–1.0)	51	6.9 (0.5–0.9)	54	7.3 (0.6–0.9)
1 to 2	261	35.4 (32.0–38.9)	273	37.0 (33.6–40.6)	255	34.7 (31.2–38.1)
3 or more	419	56.8 (53.2–60.4)	413	56.0 (52.4–59.6)	428	58.1 (54.5–61.6)
Mild cognitive impairment ^a						
Absence	590	80.7 (77.7–83.4)	587	80.3 (77.3–83.0)	568	77.7 (74.5–80.6)

Table I. Characteristics of participants in the EpiFloripa Aging Cohort Study. Florianópolis, Brazil, 2009/2019. (n = 737)						
Presence	141	19.3 (16.6–22.3)	144	19.7 (14.7–17.0)	163	22.3 (19.4–25.5)
Depressive symptoms ^b						
Absence	579	81.3 (78.3–84.0)	592	82.7 (79.7–85.3)	544	83.2 (80.1–85.9)
Presence	152	18.7 (16.0–21.7)	139	17.3 (14.7–20.3)	187	16.8 (14.1–19.9)
Source: Authors (2026). Note: ^a Mild cognitive impairment based on the Mini-Mental State Examination (MMSE). ^b Depressive symptoms based on the Geriatric Depression Scale (GDS).						

Table II. Perceived neighborhood environment characteristics among participants in the EpiFloripa Aging Cohort Study. Florianópolis, Brazil, 2009/2019. (n = 737)

Environmental variables		Wave 1 (2009/2010)	Wave 2 (2013/2014)	Wave 3 (2017/2019)
		Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Existence of sidewalks	Yes	78.2 (75.0–81.0)	79.3 (76.2–82.1)	82.6 (79.8–85.3)
Sidewalk quality	Yes	66.7 (62.7–70.5)	39.1 (35.2–43.2)	40.4 (36.0–44.0)
Green spaces near home	Yes	68.4 (64.9–71.7)	48.0 (44.4–51.6)	48.0 (44.4–51.6)
Presence of flat streets	Yes	50.1 (46.5–53.7)	46.8 (43.2–50.5)	52.4 (48.7–56.0)
Presence of litter	Yes	16.3 (13.8–19.2)	13.8 (1.5–16.5)	18.3 (15.6–21.2)
Presence of sewage	Yes	12.0 (9.8–14.5)	13.8 (1.5–16.5)	18.3 (15.6–21.2)
Traffic makes walking difficult	Yes	35.7 (32.3–39.3)	40.9 (37.3–44.5)	39.2 (35.7–42.8)
Presence of pedestrian crossing	Yes	63.7 (60.2–67.1)	68.0 (64.4–71.3)	69.9 (66.4–73.1)
Drivers respect the pedestrian crossing	Yes	62.5 (58.0–66.8)	68.2 (64.0–72.2)	57.3 (53.6–60.8)
Presence of street lighting	Yes	91.0 (88.7–92.9)	91.7 (89.5–93.5)	91.4 (89.1–93.2)
Safe to engage in PA during the day	Yes	78.7 (75.6–81.5)	82.6 (80.0–85.2)	80.6 (77.6–83.3)
Safe to engage in PA at night	Yes	34.5 (31.1–38.0)	38.1 (34.7–41.7)	39.6 (36.0–43.3)
Existence of bicycle paths and places to walk	Yes	27.9 (24.7–31.2)	-	36.9 (33.5–40.5)
Existence of parks and squares	Yes	35.1 (31.7–38.6)	-	50.8 (47.2–54.4)
Existence of sporting events	Yes	21.1 (18.3–24.2)	23.5 (20.5–26.7)	30.5 (27.2–34.1)
Source: authors (2026). Note: *95%CI: confidence interval.				

Table III. Association between the perceived neighborhood environment characteristics and transport walking among participants in the EpiFloripa Aging Cohort Study. Florianópolis, Santa Catarina, Brazil, 2009/2019. (n = 737)		
Variables	Transport walking (> 10 min/week)	
	Crude analysis	Adjusted analysis†
	OR (95% CI)	OR (95% CI)
Perceived neighborhood environment characteristics	1.08 (1.04–1.12) *	1.08 (1.03–1.12) *
Source: Authors (2026). *p < 0.001. †Adjusted for sex, age, schooling, morbidities, cognitive impairment, and depressive symptoms.		

Figures

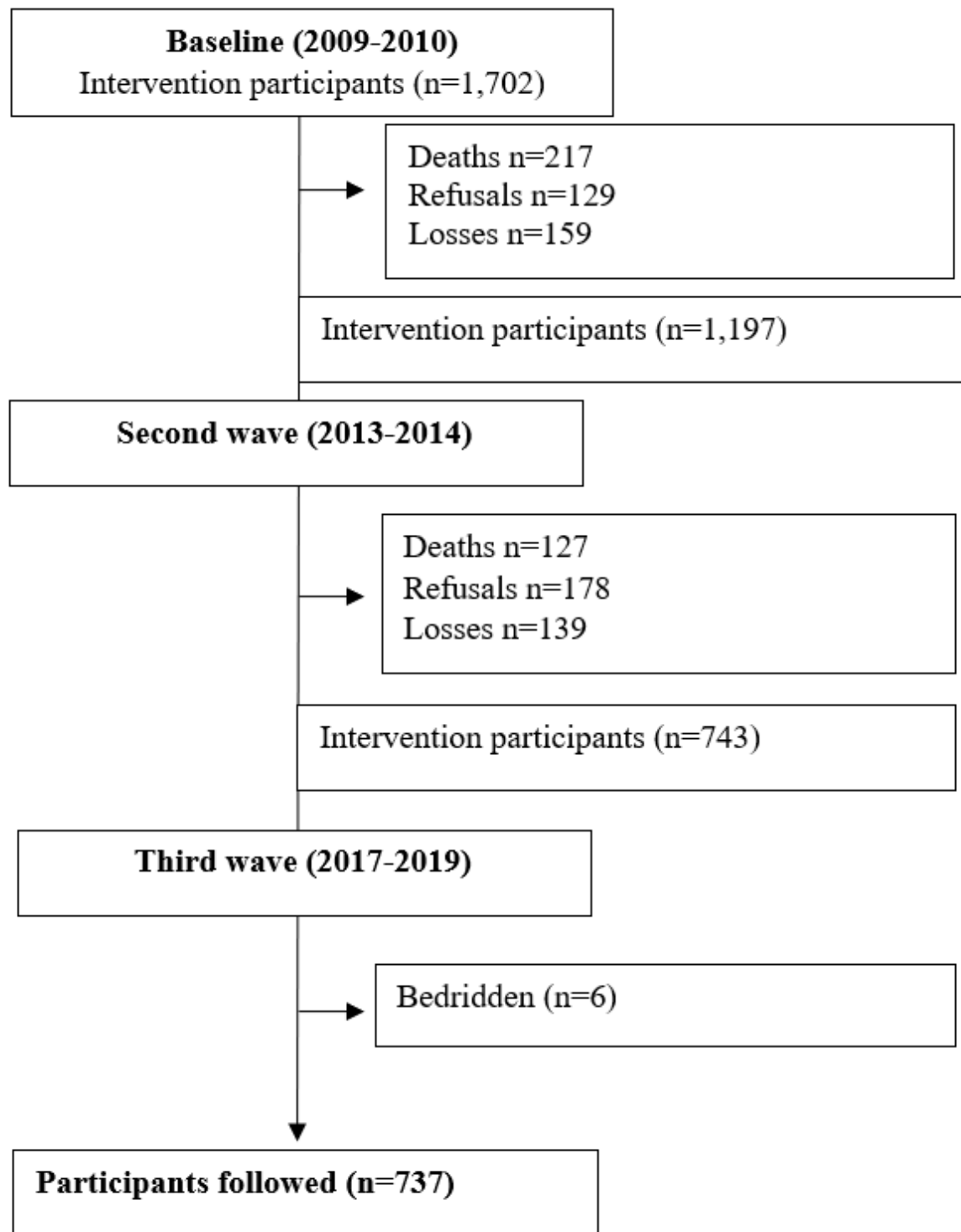


Figure 1

Flowchart of the sampling process of participants in the EpiFloripa Aging Cohort Study. Florianópolis, Santa Catarina, Brazil, 2009/2019. (n=737)

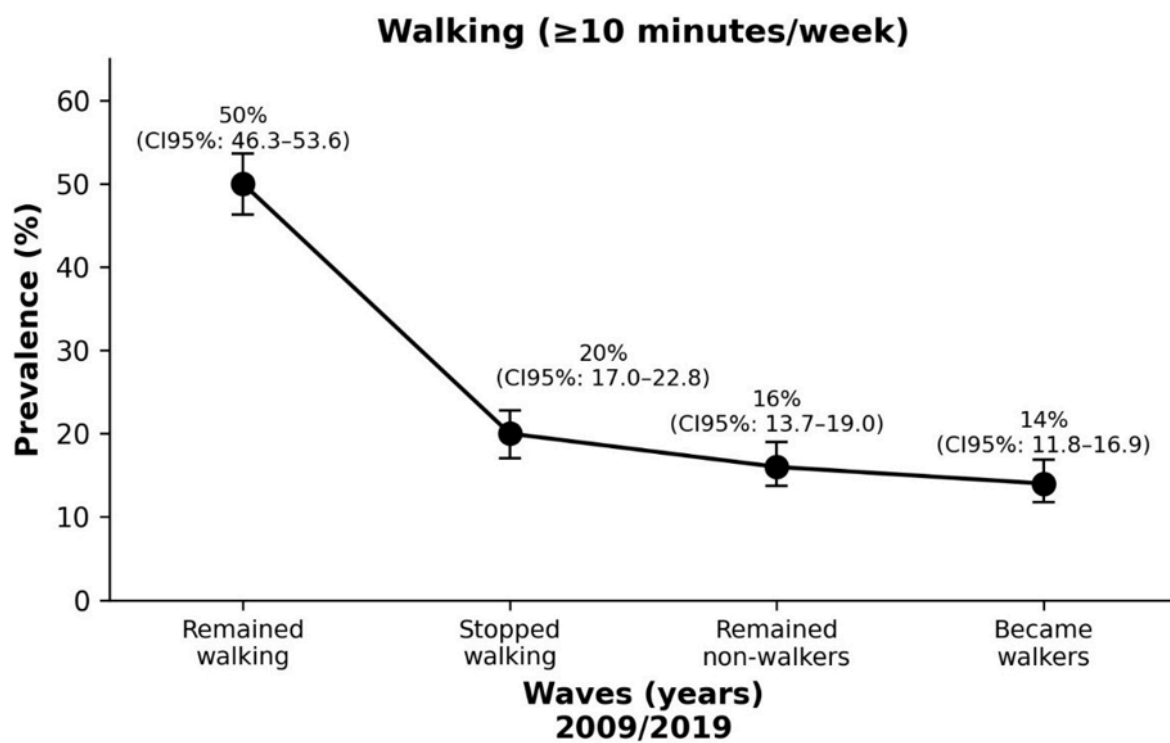


Figure 2

Change in the prevalence of transport walking (≥ 10 minutes/week) among participants in the EpiFloripa Aging Cohort Study. Florianópolis, Santa Catarina, Brazil, 2009/2019. (n=737)