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Environmental and Psychosocial Barriers to Active Commuting to University in a Spanish University Community

Isabel María Martín-López [1], Olalla García-Taibo [1,2,*], Antoni Aguiló Pons [3,4] and Pere Antoni Borràs Rotger [1,2]

[1] Physical Activity and Sport Sciences Research Group (GICAFE), Balearic Islands University, 07122 Palma de Mallorca, Spain; i.martin@uib.es (I.M.M.-L.); pa-borras@uib.es (P.A.B.R.)
[2] Department of Pedagogy and Specific Didactics, Balearic Islands University, 07122 Palma de Mallorca, Spain
[3] Global Health and Lifestyles Research Group (EVES), Department of Nursing and Physiotherapy, IUNICS, Balearic Islands University, 07122 Palma de Mallorca, Spain; aaguilo@uib.es
[4] Health Research Institute of Balearic Islands (IdISBa), 07120 Palma de Mallorca, Spain
* Correspondence: olalla.garcia@uib.es

Abstract: (1) Background: Climate change and a sedentary lifestyle have been associated with negative effects on global health and sustainable development. Active commuting (AC) represents an important solution for mitigating global warming and improving health. Thus, policies that encourage this behavior could have an impact on health and sustainability. Therefore, the aims of this study were (a) to describe the mode of commuting in university staff and students; (b) to analyze the influences of this behavior; and (c) to compare perceived barriers by mode of commuting. (2) Methods: A cross-sectional study with a descriptive design was conducted. In total, 384 university community members (79.4% students and 20.6% staff) were recruited via non-probability sampling and completed an online questionnaire. Mode of commuting, sociodemographic data, and perceived barriers were analyzed. (3) Results: Most of the sample commuted passively to university. This behavior was significantly higher in those who those lived in rural residences and a distance more than 15 km from the university, owned one vehicle, perceived higher psychosocial and environmental barriers, and were women. (4) Conclusions: Universities play a key role in health promotion and sustainable development. Therefore, they should design specific measures according to their characteristics, and barriers.

Keywords: sustainable development goals; health; active transportation; sustainable mobility; perceived barriers; higher education

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1. Introduction

The International Panel on Climate Change (2023) warns that global warming and greenhouse emissions keep increasing, and human activities continue to contribute it due to humans' unsustainable energy use, lifestyles, and patterns of consumption and production [1]. Scientific evidence indicated the potential risks of global warming on health, e.g., an increase in heat, allergies, asthma, chronic diseases, and obesity [2]. In this context, sustainable modes of transportation are potential opportunities to reduce greenhouse emissions and mitigate climate change [1]. There is documented evidence about enablers and barriers of reducing carbon emissions in transportation, with the main categories being technological innovations (e.g., electrification and alternative fuels), operational measures (e.g., vehicle routing and intermodal transportation), regulatory and economic measures (e.g., urban governance), urban form and human behavior (e.g., modal shift and shared mobility), and strategy and stakeholder pressure (e.g., business strategies and carbon polices) [3]. Regarding human behavior, the preferences for the use of individual cars prevail over shared mobility, public transportation, and less-polluting transport modes such electric bikes [3]. Regarding the university context, previous studies indicated that

the car was the main means of transport to university in Spain [4], and that most students were passive commuters [5,6]. Besides the harmful effects on global warming, passive modes of commuting contribute to physical inactivity, which is associated with most chronic diseases and with a decline in quality of life [7]. Evidence shows that university students have higher levels of sedentary time compared with the general population. In addition, this behavior has increased over the last 10-year period in this population [8]. One way to integrate physical activity (PA) into the daily routine is by active commuting (AC) to work or places of study [9]. Previous evidence registered that an increase in AC (i.e., walking or cycling) translated to an increase in overall PA [10]. In addition, previous studies have associated AC with a lower risk of mortality from any cause, and a lower incidence of cardiovascular disease and type 2 diabetes [11,12], as well as reduced stress perception [13]. Both PA and air pollution are linked through multiple physiological and behavior mechanisms, and these relations have important implications for public health [14]. Therefore, the use of non-motorized vehicles contributes to improving health by increasing physical activity levels (PAL), reducing sedentary behavior during commuting, and contributing to sustainable development. AC is an important strategy for reducing greenhouse gas emissions, in an effort to attenuate the global warming [15]. Thus, replacing car journeys with AC to university (ACU) could contribute to achieving the sustainable development goals (SDGs) of Agenda 2030 via promoting good health and wellbeing (SDG 3), sustainable cities and communities (SDG 11), and climate action (SDG 13) [16].

Given the aforementioned health and environmental benefits associated with AC, initiatives and policies that encourage PA and reduce greenhouse gas emission are required for the university population. For this purpose, understanding the influences on this behavior is essential to designing effective measures since each urban area is particular in many ways (e.g., geography, infrastructure, and socioeconomic characteristics), and, as a result, has specific transportation challenges [3]. The choice of the mode of transportation depends on multifactorial variables. Evidence showed that gender, age, residence environment, attitudes, intentions, habits, abilities, and the perception of barriers and advantages could influence this behavior [17,18]. Regarding influential social factors, some studies identified that the commuting behavior of peers and family, social support, previous attitudes of parents, and perceptions about the neighborhood could induce this conduct [19]. Lastly, connectivity, safe and walkable areas, and distance were some of the most studied and influential environmental factors [20]. On the other hand, it has been shown that the factors and barriers to AC differ in relation to commuter behavior. Therefore, interventions should consider multifactorial influences and the characteristics of a specific population [21]. Some studies pointed out that psychosocial factors increase explanatory behavior compared with infrastructural and sociodemographic factors [19,22]. However, other research concluded that environmental and safety barriers were bigger than planning and psychosocial barriers [23]. Distance, lack of time, weather conditions, the state of the roads, and fatigue were some of the main barriers for students who commute passively [24,25]. These differences point out the importance of analyzing specific contexts in order to design effective strategies. In addition, this should be based on an evidence framework to achieve modal and behavior change [26]. Some studies suggested that policies, programs, and infrastructure designed to support AC to campuses could have long-lasting effects on transportation habits [27]. Therefore, universities have a fundamental role in promoting health through the encouragement of sustainable mobility on their staff, students, and campuses [28].

Considering the importance of AC in addressing the current issues of pollution and sedentary lifestyles, and the potential that the university community represents a contribution to this goal, it becomes essential to better understand people's decision-making processes of selecting travel modes to the university. Thus, the aims of this study were (a) to describe the mode of commuting in university students and staff; (b) to analyze the

influences of sociodemographic data, body mass index (BMI), health perception, and PAL on ACU; and (c) to compare perceived barriers to ACU by modes of commuting.

2. Materials and Methods

2.1. Study Design and Participants

This cross-sectional study with a descriptive design was conducted in the Sustainable and Healthy Office at the Balearic Islands University during the academic course of 2020–2021 as part of a promotional plan to encourage AC in the university community. In total, 384 people, comprising 305 students (52% female and 48% male) aged 21.46 ± 5.48 years and 79 staff (53% female and 47% male) with an average age of 37.33 ± 9.54 years, participated in this study. Convenience (non-probabilistic) sampling was conducted to obtain this sample. This research and the informed consent were approved by the Ethics Committee of the Balearic Islands University on 11 February 2021 (approval code: 172CER20).

2.2. Measures and Instruments

Participants completed an online questionnaire structured into three sections: (a) sociodemographic and individual data; (b) modes of commuting; and (c) perceived barriers to ACU.

2.2.1. Sociodemographic and Individual Data

Gender, age, type of collective, residence environment, and owning motorized vehicle were included as sociodemographic data. Dichotomic response options were included in these questions. On the other hand, a question on general health perceptions [29], weight, and height, to calculate body mass index (BM) and physical activity levels (PAL) as measured via the International Physical Activity Questionnaire short version (IPAQ-SF) [30], were encompassed.

2.2.2. Mode of Commuting

The Modes of Commuting to University Questionnaire (MODU) was used [31]. The questionnaire included the means of transport and reasons for its use (open question), and distance and time to commute to university. The options of answers to the question on commuting distance were modified regarding the distance of the University of Balearic Islands by dividing it into five categories: <5 km, between 5 and 10 km, between 11 and 15 km, between 16 and 20 km, and >20 km. Participants were classified dichotomously into active and passive commuters for subsequent analysis.

2.2.3. Perceived Barriers to Active Commuting to University

The Barriers to Active Commuting University Scale was included considering its suitability in assessing barriers to active commuting specifically within the university setting. This instrument was validated in the university population [32]. Perceived barriers were classified into environmental and safety barriers (7 items), and planning and psychosocial barriers (7 items), with a Likert-type response scale from 1 to 4 (1 = totally agree, 2 = agree, 3 = disagree, and 4 = strongly disagree). The interpretation of the coefficients was conducted by taking those used by Palma-Leal as a reference.

2.3. Procedure

The participants were recruited through announcements on social media, on the website university, flyers in the concierges, and face-to-face points. All of them agreed to participate voluntarily in the study and signed an informed consent form in which they agreed to respond to an online questionnaire for the purpose of the study.

2.4. Statistical Analysis

Descriptive statistics analysis was used to describe the mode of commuting to university and analyze psychosocial and environmental factors by commute modes to university. Mean and standard deviation (SD) were reported for continuous variables, and frequencies and proportions (%) were reported for categorical variables. The Wilcoxon test for continuous variables and Chi-square test (χ^2) for categorical variables were used to analyze significant differences by commute mode. The level of significance was set to a p-value < 0.05. All statistical analyses were carried out with Statistical Package for Social Sciences, version 29.0.1.0 (171) (IMB SPSS).

3. Results

3.1. Mode of Commuting

Means of transport (a) and modes of commuting (b) are displayed in Figure 1. The car was the main means of transport both on a regular basis (33.85%) and to university (57%). Cars' quickness, the comfort it allows, and the long distance of the trip were the more relevant reasons to use them. There were significant differences between modes of transport regarding their use on regular basis and to commute to university ($p < 0.001$). Passive modes of transport were predominantly used to commute to university (87.76%) compared with the modes of commuting regularly (47.14%). On the other hand, active modes of transport were dominantly used on a regular basis (52.86%) compared with those used to commute to university (12.24%). Walking (14.32%) was the most commonly used mode for commuting on a regular basis, followed by using a bicycle (6.77%). In contrast, using a bicycle (8.1%) was the primary active means of transport to university compared with walking (2.6%). The main reasons for its use were because it is healthy, ecological and cheap.

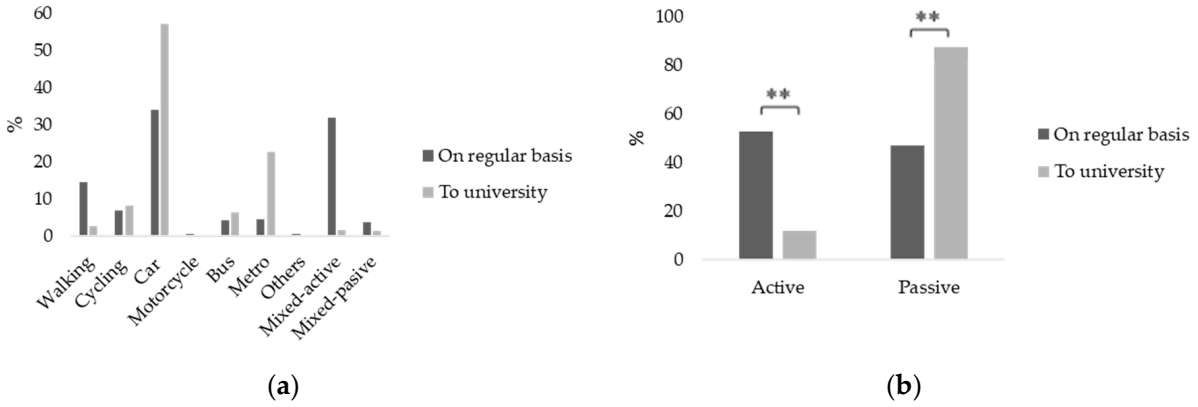

Figure 1. (**a**) Means of transport; (**b**) modes of commuting to university and of commuting on a regular basis. Notes: ** = significant differences in mode of commuting with $p < 0.001$.

3.2. Sociodemographic and Individual Factors in Relation to Mode of Commuting

The gender, type of collective, residence environment, owning a motorized vehicle, distance and time to university, health perception, BMI, and PAL of the entire sample and separated by mode of commuting are presented in Table 1. Passive commuting behavior was the highest in females ($p < 0.05$), those who lived in a rural residence environment ($p < 0.05$), those who had their own vehicle ($p < 0.001$), and those who lived at a distance greater than 15 km ($p < 0.001$). There were no significant differences between mode of commuting and age, BMI, duration of the trip to university, health perception, and PAL.

Table 1. Sociodemographic and individual characteristics of the participants.

Characteristics	All (n = 384) (%)	PCU (n = 337) (%)	ACU (n = 47) (%)	p-Value
Gender				
Female	202 (52.6)	187 (55.5)	15 (31.9)	0.008
Male	180 (46.9)	148 (43.9)	32 (68.1)	
Other	2 (0.5)	2 (0.6)	-	
Type of collective				
Students	305 (79.43)	274 (81.3)	31 (66)	0.015
Staff	79 (20.57)	63 (18.7)	16 (34)	
Residence environment				
Urban	313 (81.5)	268 (79.5)	45 (95.7)	0.007
Rural	71(18.5)	69 (20.5)	2 (4.3)	
Owning a motorized vehicle				
Yes	349 (90.89)	315 (93.5)	34 (72.3)	<0.001
No	35 (9.11)	22 (6.5)	13 (27.7)	
Distance to university				
<5	6 (1.6)	6 (1.8)	-	<0.001
5–10	21 (5.5)	11 (3.3)	10 (21.3)	
11–15	228 (59.4)	196 (58.2)	32 (68.1)	
16–20	30 (7.8)	30 (8.9)	-	
>20	99 (25.8)	94 (27.9)	5 (10.6)	
BMI				
Low weight	33 (8.6)	30 (8.9)	3 (6.4)	0.71
Normal	288 (75.0)	251 (74.5)	37 (78.7)	
Overweight	53 (13.8)	48 (14.2)	5 (10.6)	
Obesity	10 (2.6)	8 (2.4)	2 (4.3)	
Health perception				
Very good	93 (24.22)	78 (23.1)	15 (31.9)	0.63
Good	234 (60.94)	209 (62)	25 (53.2)	
Regular	52 (13.54)	45 (13.4)	7 (14.9)	
Bad	4 (1.04)	4 (1.2)	-	
Very bad	1 (0.26)	1 (0.3)	-	
PAL				
Low	3 (0.8)	3 (0.9)	-	0.23
Moderate	145 (37.8)	132 (39.2)	13 (27.7)	
Vigorous	236 (61.5)	202 (59.9)	34 (72.3)	

Notes. PCU = passive commuters to university; ACU = active commuters to university; p-value of the Chi-square test with significant differences $p < 0.05$.

3.3. Perceived Barriers to Active Commuting to University in Relation to Mode of Commuting

Environmental and psychosocial barriers to ACU of the entire sample and separated by mode of commuting are presented in Table 2. Results indicated that both psychosocial (2.62 $\pm$ 0.72) and environmental barriers (2.41 $\pm$ 0.71) influenced commuting behavior. All perceived barriers were significantly higher in passive commuters than in active commuters except for two environmental items: "The bike lanes are occupied by people who are walking" and "There is nowhere to leave a bike safely". Passive commuters had bigger psychosocial barriers compared with environmental ones. "It takes too much time" (3.12 $\pm$ 1.06), "I need the car or motorcycle for work reasons", and "I am too loaded with things" (3.04 $\pm$ 1.04) were the most relevant barriers. On the contrary, active commuters perceived more environmental barriers. "There are one or more dangerous crossings"

(2.51 ± 0.98), "I am too hot and sweaty" (2.51 ± 0.91), and "I am too loaded with things" (2.4 ± 1.06) were the biggest barriers for this group.

Table 2. Statistical analysis of the perceived barriers of ACU for the whole sample and for commuting behavior.

Perceived Barriers	All χ ± SD	PCU χ ± SD	ACU χ ± SD	*p*-Value
Environment and safety barriers				
There are no sidewalks or bike lanes	2.59 (1.18)	2.66 (1.18)	2.13 (1.08)	0.004
The bike lanes are occupied by people who are walking	2.16 (0.99)	2.19 (0.98)	1.98 (1.03)	0.14
There is too much traffic	2.65 (1.14)	2.78 (1.10)	1.68 (0.96)	<0.001
There are one or more dangerous intersections	2.92 (1.03)	2.98 (1.03)	2.51 (0.98)	0.002
It is unsafe because of crime to walk or bike	1.94 (1.08)	2.01 (1.10)	1.43 (0.83)	<0.001
There is nowhere to leave a bike safely	2.18 (1.09)	2.22 (1.08)	1.94 (1.09)	0.073
The road does not have good lighting	2.44 (1.04)	2.5 (1.03)	2 (0.96)	0.002
Average of total of environment and safety barriers	2.41 (0.71)	2.48 (0.7)	1.95 (0.67)	<0.001
Planning and psychosocial barriers				
I experience too much heat and sweating	2.80 (1.03)	2.85 (1.04)	2.51 (0.91)	0.021
I carry too many things	2.96 (1.06)	3.04 (1.04)	2.4 (1.06)	<0.001
It is easier to drive or take me	3.15 (1.06)	3.29 (0.96)	2.15 (1.23)	<0.001
It involves too much planning ahead	2.33 (1.04)	2.44 (1.02)	1.53 (0.80)	<0.001
It is very far	2.97 (1.13)	3.12 (1.06)	1.85 (1.0)	<0.001
It takes too much physical effort	2.27 (1.05)	2.33 (1.04)	1.85 (0.98)	0.003
I do not enjoy cycling	1.92 (1.05)	1.99 (1.06)	1.38 (0.77)	<0.001
Average of total of planning and psychosocial barriers	2.62 (0.72)	2.72 (0.68)	1.95 (0.7)	<0.001

Notes. PCU = passive commuters to university; ACU = active commuters to university; *p*-value of Wilcoxon test with significant differences $p < 0.05$.

4. Discussion

4.1. Mode of Commuting

The car was the primary means of transport used both to commute to university and to commute on a regular basis. However, it was significantly more common to use it to go to university. As a consequence, the majority of the sample comprised passive commuters to university. These findings are consistent with previous studies, which indicated that passive means of transport were the most commonly used to commute to university [4,5,24,33,34]. The main difference in our results comes from the fact that the University of Balearic Islands is located 7–8 km away from the city and that the threshold indicated in previous studies for ACU was 2.6 km by walking and 5.1 km by cycling [5]. Moreover, although more than half of the study participants resided in the city, some of the participants live in other towns that are located even further from university. On the contrary, in the study by Molina et al. (2015), in which students lived close to university, the main commuting mode was walking [35]. However, our findings showed a similar proportion of people who cycle to university (8.1%) compared to those indicated in other universities integrated into the city, such as the University of Valencia (10.6%), located about 4.2 km from the residence area of the students. Therefore, the distance between the residence area and the university was a determining factor for ACU. It would be necessary to implement measures that minimize this factor, such as by improving the bike lane, implementing electric bike services, and qualitatively understanding the barriers and reasons that drive people to commute actively or passively.

4.2. Sociodemographic and Individual Factors in Relation to Mode of Commuting

According to sociodemographic factors, our results showed that passive commuting was highest in women, staff, participants with their own vehicle, and those who lived away from the university and in a rural area. Although passive commuting was significantly higher in women, our results indicated that the use of bicycle as a means of transport was

higher in women than that in men. These findings support the previous study by Goel et al. (2022), which indicated that active commuting was lower in women in most European countries. However, they concluded that women had the same probability of cycling in countries with high levels of cycling behavior [36]. Therefore, it seems that other factors could influence ACU more. Regarding the type of participant, the mode of commuting was more passive in staff. Despite the fact that the study sample size was small in this group, these results could be explained by the socioeconomic factor of having one's own vehicle. This factor was significantly associated with passive commuters in our results, as well as in previous studies [17,21]. In fact, these participants highlighted the comfort and speed provided by their own car. Regarding the residence area, our results indicated that people who lived in a rural environment were more passive commuters than those who lived in an urban residence. Unlike our results, living in a rural area is considered friendlier for AC due to its smaller size and less traffic [21]. A possible explanation for our findings could be the fact that rural environments are further away from the university. Therefore, in our specific context, distance could influence this association. On the other hand, it should be taken into account that most secondary or rural roads are not adapted for cycling, and in some cases, they can be dangerous.

The individual factors studied, such as health perception, BMI, and PAL, were not associated with ACU. However, other previous studies such as that of Page and Nilsson (2017) indicated that the use of the bicycle as a means of transport was associated with a higher perception of health and wellbeing [37]. In addition, prior research demonstrated an association between AC and higher PAL, and better cardiorespiratory physical condition and body composition [10,38–40]. Regarding PAL, an important indicator of health, Laeremans et al. (2017) pointed out that an increase in AC resulted in an increase in overall PA, but there was no influence of an increase in PA on leisure time. In addition, this increase was conditioned by gender (lower in women), and by the season (lower in winter and summer). Therefore, to clarify this association, more robust investigations with objective measures of these indicators are needed.

4.3. Perceived Barriers to Active Commuting to University in Relation to Mode of Commuting

Environmental and psychosocial barriers to ACU were higher in people who commuted passively than those who did so actively. It is important to understand the perceived barriers to commuting in individuals who partake in either active or passive mobility. Therefore, specific strategies need to be established in health promotion and health education. These strategies involve modifying individuals' perspectives and beliefs, as well as addressing environmental factors. Additionally, providing information about safe routes and the availability of suitable infrastructure is crucial.

Our results showed that the greatest barriers for passive commuters were planning and psychosocial barriers; however, those who were active commuters had both planning and psychosocial barriers, and environmental and safety barriers. In line with these results, Molina-García et al. (2010) pointed out that both psychological and environmental barriers had a significant correlation with active commuting to university. However, planning and psychosocial barriers, and the provision of facilities for walking and cycling to university were the greatest [41]. In this regard, Villa-González et al. (2012) indicated that psychological factors increased the explanatory power of commuter behavior compared with infrastructural and sociodemographic factors. Along the same lines, the study by Castillo-Paredes et al. (2021) concluded that there were more barriers caused by personal and psychosocial factors compared with those caused by environmental barriers for ACU [42]. Unlike these findings, Cerro-Herrero et al. (2020) pointed out that environmental and safety barriers were bigger than planning and psychosocial barriers in teachers for ACU. In line with this, Bhandal and Noonan (2022) indicated that intrapersonal and environmental factors had a greater influence than social factors did [43]. These differences highlight the importance of analyzing specific contexts in order to design effective measures that reduce the perceived barriers to ACU in each target group. Regarding the main influential barriers

in students, Cerro-Herrero et al. (2018) pointed out distance, lack of time, meteorological conditions, the state of roads, and fatigue. Regarding barriers in passive commuters to university, Castillo-Paredes et al. (2021) indicated that students perceived that ACU involved too much planning and time. Accordingly, Kaplan (2015) concluded that the main impediments were the time involved, busy streets, inconveniences, security concerns, not having a place to park, and lack of fitness [25]. Despite the fact that many perceived barriers are owed to planning and psychosocial aspects, it must be taken into account that solid infrastructures such as the availability of lanes, safe places to park bicycles, and other amenities in the work and study place contribute positively to ACU [17]. In relation to this, Dufour (2010) indicated that countries with high-quality cycling infrastructure had higher AC [44].

4.4. Limitations, Strengths, and Future Directions

The sample size could have been a limiting factor in the study. In addition, the low proportion of active individuals, combined with the wide variety of variables influencing mobility patterns, may have contributed to this limitation. On the other hand, introducing more objective measures could have enhanced the consistency of the results. These limitations should be taken into account when interpreting the results. Nevertheless, this analysis offers valuable information for designing specific strategies that contribute to reducing barriers to ACU. In addition, it is important to highlight that to the best of our knowledge, this is the first study analyzing the barriers and influences of AC in the university community, including teachers and staff. To support these findings, future research should include teaching research and working staff of the university community in analysis, since they represent integral components of the university community, and since this is needed to improve ACU in the whole population. By doing so, proposed interventions and measures should address the needs of the entire university population. Moreover, to achieve a change in the behavior of commuting to university, our findings underscore the necessity of implementing multilevel interventions that consider contextual analysis alongside an analysis of the distinct characteristics and requirements of the university community. Considering the identification of time and distance as prevalent inconveniences to the majority of university members, initiatives should overcome these barriers. Providing electric bicycle services in conjunction with awareness campaigns on adopting more active and sustainable transportation modes emerges as a potentially efficacious strategy. Finally, it would be interesting to start from a holistic approach that includes measures aimed at changing individual, social, infrastructural, and political factors.

5. Conclusions

The main findings in this study were that (a) the car was the main means of transport and that most of the university community was made up of passive commuters to university; (b) those living more than 15 km from the university and in a rural environment, those with their own vehicle, and those who were female were associated with passive commuters, and (c) perceived barriers were significantly different and higher for passive commuters compared with active commuters. In order to encourage ACU, it is necessary to implement actions that enhance its benefits and reduce the perceived barriers in specific contexts. It might be more effective to focus on planning and psychosocial measures for passive commuters and favoring structure and safety actions for active commuters. At the same time, it should be taken into account that some influencing factors in ACU such as distance and residence area cannot be modified. Therefore, it would be required to include complementary measures that encourage mixed commuting, such as public transport and using a bicycle.

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Informed Consent Statement: Informed consent was obtained from the participants involved in this paper.

Data Availability Statement: Data are available on request.

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Conflicts of Interest: The authors declare no conflicts of interest.

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