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What distance do university students walk and bike daily to class in Spain

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ABSTRACT

Introduction: Physical activity levels are low in the general population and these levels decrease from childhood to adolescence, as well as from adolescence to adulthood. Active commuting (AC) is an opportunity to increase the physical activity levels. The distance between home and destinations is a main correlate of AC; however, the distance that university students walk or cycle to university is unknown.
Methods: Participants self-reported their modes and time of commuting to and from university in a questionnaire, and the main mode of commuting was identified. Moreover, they reported their home address, and the Spanish version of Mapquest software was used to measure street-network distance (kilometers) from home to university. The 'threshold' distance for walking and cycling was calculated through the Receiver Operating Characteristic (ROC) curve analyses.
Results: AC rates decreased with longer distances from home to university for walk ($p < 0.001$) and bike ($p = 0.002$). The threshold distance that university students walked was 2.6 km and the threshold distance that they cycled was 5.1 km.
Conclusion: Public health decisions at university should consider the distance that students actually walk and cycle. Locating university accommodation facilities within a walkable or cyclable distance from university might increase the AC rates among the university population.

1. Introduction

There is a clear evidence of the effectiveness of regular physical activity in the prevention of health risks including obesity-related diseases in adolescents (Rauner et al., 2013) and adults (Sodlerlund et al., 2009). In spite of these benefits, the levels of physical activity are low in the general population and these levels decrease from childhood to adolescence, as well as from adolescence to adulthood (Kwan et al., 2012; Ortega et al., 2013). The transition out of high school is often accompanied by unhealthy behavior changes such as decreasing physical activity and increasing sedentary behaviors (Vella-Zarb and Elgar, 2009). Recent longitudinal studies have shown that this decrease in physical activity during this transition is associated to a decline on active commuting (AC) (i.e., walking and cycling for transportation) and, moreover, the most important factor explaining this trend is the increase in the distance from home to university compared to the distance from home to high school (Molina-Garcia et al., 2015b; Van Dyck et al., 2015).

According to Irwin's review (Irwin, 2004), approximately half or more university students from the United States, Canada and China, 40% from Australia and 67% from Europe, were insufficiently active. It is a serious health concern among university students and appropriate strategies to increase physical activity levels must be implemented. In this regard, the behavior of AC to and from university might be a source for increasing the physical activity levels. Actually, there is evidence that U.S. and Spanish students who cycled or walked to university had higher levels of physical activity than those students who used passive modes of commuting (Molina-Garcia

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et al., 2014; Sisson and Tudor-Locke, 2008). Active modes of commuting have been associated with several health benefits, such as healthy weight and improvements in risk factors for chronic diseases in youths and adults (Hendriksen et al., 2010; Oja et al., 2011). However, rates of AC to university in the Spanish population are quite low (35%) (Molina-Garcia et al., 2014) and further explorations of the determinants of AC among university students are required.

Travel distance to school has been shown as the main determinant of AC among young people, with shorter distances associated with higher rates of AC (Chillon et al., 2014; Pont et al., 2009). Moreover, the distance that young people are willing to walk to school have been previously studied: children (10–11 years old) walked around 1.5 km and adolescents (14 years old) around 3 km (Chillon et al., 2015). However, evidences of the association of the distance with the mode of commuting among university students and the distance that they are willing to travel using both active and passive modes of commuting are lacking.

For this reason, the aims of the current study are: (a) to study the association between distance from home to university and mode of commuting, and (b) to identify specific threshold distances below which university students are more likely to walk and bike as opposed to using passive modes of commuting.

2. Methods

Participants were 518 undergraduate students (22.4 years, SD 5.3; 59.7% female) from two urban universities in Valencia (Spain) recruited via convenience sampling in classes. The entire city is nearly flat terrain and there were 130 km of bicycle lanes at the time of study (Molina-Garcia et al., 2015b). Because university schools are integrated into the city urban area, the surrounding neighborhoods have high levels of residential density, street connectivity and land mixed-use. Participants lived in the city of Valencia and its metropolitan area, as well as in rural areas of the Valencian region. A paper survey was self-completed, requiring about 20 min during class (April and May 2009). An institutional approval of the study protocol was obtained from participating university schools and central university administrations. Informed consent was obtained from all participants before study enrollment.

2.1. Measures

2.1.1. Mode of commuting

Modes of commuting to university were measured by "How often do you use each of the following ways to go to and from the university?" Response options were bike, bus, car, train/metro/tram, motorbike, and walking. Participants indicated the number of trips per week (to or from university) and usual minutes per trip in each mode of transport. The main mode of transport to university among students who used mixed mode trips (e.g., bike to train) was assigned based on the longest (in minutes) portion of their trip. Test–retest reliability for each item (modes of transport) was good in previous studies and ICCs were above 0.90 (Molina-Garcia et al., 2014).

2.1.2. Distance to university

Participants reported their home and university addresses. The Spanish version of Mapquest software was used to measure street-network distance (kilometers) from home to university (www.mapquest.es), as in a previous study (Molina-Garcia et al., 2010). Mapquest uses Dijkstra's shortest path algorithm to road maps to plot the shortest route between the two locations (Bliss et al., 2012).

Table 1
Descriptive characteristics of the sample regarding one and mixed-mode commuting.

	All ($n=518$) N (%)	One-mode ($n=196$) N (%)	Mixed-mode ($n=322$) N (%)	p
Gender				0.451
Male	209 (49.3)	75 (38.3)	134 (41.6)	
Female	309 (59.7)	121 (61.7)	188 (58.4)	
Age (years)	22.4 (5.3)	22.9 (5.3)	22.1 (5.2)	0.077
BMI (kg/m^2)	22.2 (2.9)	22.2 (2.7)	22.2 (3.0)	0.820
Mode of commuting				**< 0.001**
Walk	126 (24.3)	83 (42.3)	43 (13.4)	
Bicycle	55 (10.6)	32 (16.3)	23 (7.1)	
Car	80 (15.4)	56 (28.6)	24 (7.5)	
Train	161 (31.1)	0 (0.0)	161 (50.0)	
Bus	71 (13.7)	1 (0.5)	70 (21.7)	
Motorcycle	25 (4.8)	24 (12.2)	1 (0.3)	
Distance to university (m)[a]	4.2 (2.2,5.8)	2.6 (1.4,5.5)	6.8 (3.1,19.5)	**< 0.001**
Access to car/motorbike				**< 0.001**
Never	172 (33.2)	55 (28.1)	117 (36.3)	
Sometimes	320 (61.8)	124 (63.3)	206 (60.8)	
Always	26 (5.0)	17 (8.7)	9 (2.8)	
Socioeconomic status				0.061
Low	13 (2.5)	1 (0.5)	12 (3.7)	
Middle	497 (95.9)	191 (38.4)	306 (61.6)	
High	8 (1.5)	4 (2.0)	4 (1.2)	
Type of residence				**< 0.001**
Family	382 (73.7)	115 (58.7)	267 (82.9)	
University	136 (26.3)	81 (41.3)	55 (17.1)	
Type of university				0.619
Public	318 (61.4)	123 (62.8)	195 (60.6)	
Private	200 (38.6)	73 (37.2)	127 (39.4)	

[a] Expressed as Median (25th, 75th) percentile.