Active commuting to school among 36,781 Spanish children and adolescents: A temporal trend study

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Introduction

Despite the well-recognized health benefits of physical activity, such as, reduce the likelihood of obesity, diabetes, hypertension, colon cancer and mental illnesses (Physical Activity Guidelines Advisory Committee, 2008), only one of five adolescents obtaining adequate physical exercise per day (Rodhes et al., 2017). In fact, around eighty percentage of Spanish adolescents present insufficient physical activity **(**Guthold et al., 2019). To obtain benefits from physical activity, the 2018 Physical Activity Guidelines for Americans have recommended a minimum of 60 minutes of moderate-to-vigorous physical activity for children and adolescents aged 6 to 18 years (USDHHS, 2008; USDHHS, 2018).

Active commuting to school (ACS), defined as the use of active means of transport, such as walking or cycling to and from school, is an opportunity for children and adolescents to increase physical activity levels (Kallio et al., 2016; Chillón et al., 2010). In the most recent systematic review about effects of active commuting to school on physical activity, 40 out of 49 studies reported that children and adolescents who commuted actively accumulated more daily physical activity compared to users of motorized transport (Larouche et al., 2014). In addition, adolescents that walking to school would increase their steps 9% from the 11,500 daily steps recommended for them in the scientific literature (Adams et al., 2013). Furthermore, ACS is related to many health benefits in children and adolescents, such as the reduction of metabolic diseases (Walker et al., 2013), lower obesity and type II diabetes prevention (Mytton, Panter & Ogilvie, 2016; Pucher et al., 2010), and cardiorespiratory fitness improvement only when cycling (Chillón et al., 2012). Moreover, ACS is perceived as an easy and effective tool to improve the social support (Panter et al., 2010) and independent mobility (Ming Weng et al., 2010). Children engaging in independent mobility perceived their home neighbourhoods to be more safe compared to children who did not engage in independent mobility (Herrador-Colmenero, Villa-González & Chillón, 2017). Additionally, ACS is the mode of commuting with the lowest level of air pollution and allows to reduce traffic congestion (Wilson, Wilson, & Krizek, 2007; Van Dick et al., 2010).

However, several studies have consistently demonstrated a decline in the last decades in the prevalence of ACS among young people in the United States in America (Colley & Buliung, 2016; McDonald, 2007), in the United Kingdom, Spain, Switzerland, and Czech Republic in Europe (Black, Collins & Snell, 2001; Chillón et al., 2013; Grize et al., 2010;

Pavelka et al., 2017), Vietnam in Asia (Trang, Hong & Dibley, 2012), and Australia and New Zealand in Oceania (Hinckson, Garrett & Duncan, 2011; Meron et al., 2011; Van der Ploeg et al., 2008). Regarding the European studies, a study from the United Kingdom (Black, Collins & Snell, 2001) included data between 1975-1994 of children aged 5 to 10 years old, reporting a decrease of 9% in walking to school. A similar trend, was found in a study developed in Switzerland, which included data from 1994 and 2005 of children aged 6 to 14 years old (Grize et al., 2010), reporting a decrease of 7% in the prevalence of ACS. Worse perspectives were found recently in the Czech Republic (Pavelka et al., 2017), where it is reported a decrease of 20% in the prevalence of ACS in adolescents aged 11 to 15 years old between 2006-2014. Finally, in Spain, a study (Chillón et al., 2013) included data from 2001 and 2007 of adolescents aged 13 to 17 years old, reporting a decrease from 61% to 46% in walking to school.

Despite all, studies focused in Spanish young people are lacking. Only one study analyzed the changes in Spain but it was performed in the last decade and it included only two measurement points (Chillón et al., 2013). It is necessary to understand the changes of the mode of commuting in the last years in Spain in order to develop effective interventions to increase the ACS. Consequently, the aim of this study was to analyze the changes in the rates of ACS in Spanish children and adolescents aged 6–17 years old from 2010 to 2017, using cross-sectional data from several studies.

Methods

Study design

This study analyzed cross-sectional data about the modes of commuting to and/or from school from 28 databases (hereinafter called studies) including Spanish children and adolescents between the years 2010 and 2017. This study is part of the PACO ("Cycle and Walk to School") Study, that focuses on examining updated data on the rates of active commuting to and from school in order to, secondly, design and implement intervention strategies to promote this behavior. The Medical Ethics Committee of University of Granada approved the study design, study protocols and informed consent procedure (case no. 162/CEIH/2016).

Procedure

Data were obtained from original researches conducted in Spain by research centers and local/regional public institutions, since 2010. Firstly, the potential researches with mode of commuting to/from school data, were searched following a 3-step process: 1)

electronic search about studies conducted in Spain about mode of commuting to/from school, 2) recruitment presentation in the national seminary meeting "Childhood and Mobility" organized by the Spanish Ministry of Agriculture, Food and Environment in 2016, and 3) recruitment presentation in the National Congress "The Bike and the City" in May 2017. After this process, two researchers contacted by email with 20 different Spanish research centers and local/regional public institutions to invite them to participate in the current study, providing them information about: a) the aims and content of the PACO Study, b) the benefits of participating in the study, and c) the recruiting data about the mode of commuting of children and adolescents. The research centers and local/regional public institutions that agreed to take part in the study were asked in a second email for more specific data regarding the collected date (month and year) and city, the students' age, gender, height, weight and body mass index, every data about mode of commuting to and from school, as well as other data about socioeconomic level, physical activity levels, independent mobility, and/or academic achievement.

A total of 245 emails and several phone calls were exchanged between the research PACO Study team and both research centers and local/regional public institutions involved in this study, to answer individual questions about procedure to share the study. To homogenize and ensure the quality of the collected data, the following inclusion criteria were established: 1) the study had to use a questionnaire for data collection, 2) data had to be included in the study individually for each participant and 3) the compulsory required data of the study were: any variable of mode of commuting to and/or from school, age, gender, city, and date of the data collection. The 20 invited Spanish research centers and local/regional public institutions, agreed to participate and provided a total of 34 studies. In addition, from the 34 studies, only 28 studies achieving the inclusion criteria and were included.

Sample

Researchers collected information about density, city income and place of residence. All the 28 studies, were merged in one database composed finally by a total sample size of 55,957 preschoolers, children and adolescents. The inclusion criteria of the participants in this study were: 1) information about gender, age, active commuting to school (ACS) and city and 2) studies from 2010 to 2017, and 3) age between 6 and 18 years old and 4) ≥30 inhabitants per city. The final database was reviewed in relation to the inclusion criteria and any specific case with missing information about ACS, gender or age was deleted from the database. Consequently, participants who did not reported their gender

(n=294), their age (n=299), their mode of commuting to and/or from school (n=5,169), and their city (n=401), were excluded. Moreover, participants who were involved in studies developed before the year 2010 (n=7,584) and participants who did not have an age between 6 and 18 years old (n=5,013) were excluded. Finally, participants who were involved in cities with <30 inhabitants per city (n=1,704) were excluded. The final sample size included a total of 35,493 children and adolescents. The process of merging individual studies into the final study was double-checked by two different researchers.

The final sample size included 17,617 children from 6 to 11.99 years old (50.5 % girls) and 17,876 adolescents from 12 to 18 years old (49.1 % girls) from Spain (Figure 1). Participants were from 294 different Spanish cities. Description of the main characteristics and collecting dates of the 28 studies included are presented in Table 1 (see additional file).

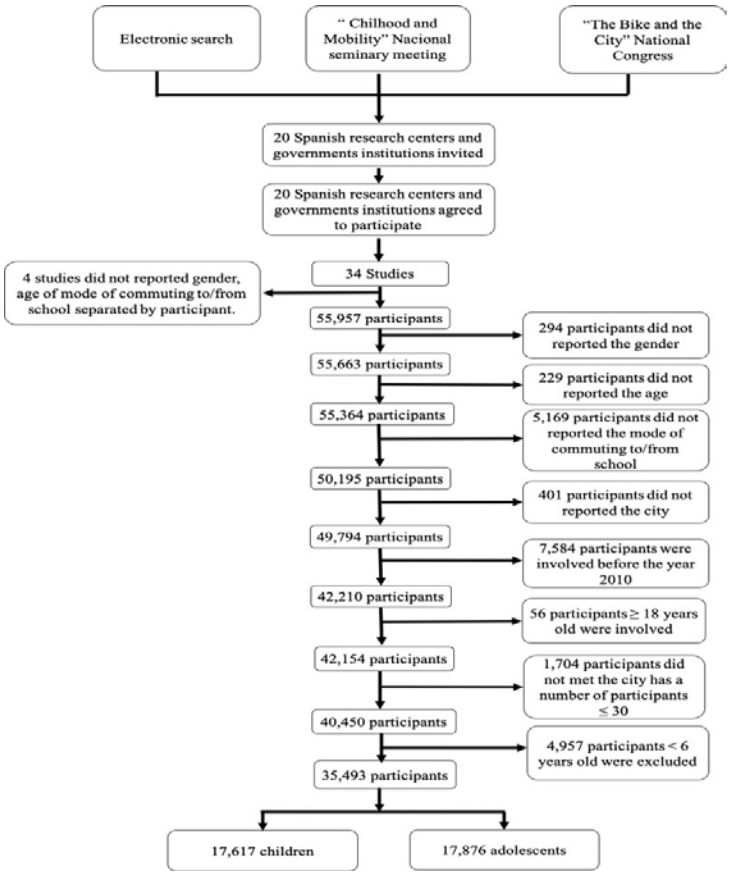

Figure 1. Flowchart of the study

Mode of commuting to and from school

The mode of commuting to and/or from school was assessed in the 28 studies using 29 different questions (Figure 2). Out of the 28 studies: 4 studies reported the frequency of commuting to/from school (i.e., 1 study reported the number of days using each mode of commuting to and from school in a week separately; 1 study reported the number of days

using an active mode of commuting to/from school such as walk, bike or skate; and 2 studies reported the mode of commuting to school every single day and the mode of commuting from school every single day) and 24 studies reported the usual mode of commuting to/from school (i.e., 12 asked about the mode of commuting to school and from school separately and 12 of them asked about the mode of commuting to/from school).

Regarding the answers provided to the previous questions, there were a total of 19 different response options reported among the studies (see figure 2). These were categorized as: active vs. passive. The multimodal modes (i.e. using two or more different modes of commuting for the same trip) were only categorized it both modes could be classified in the same category (i.e., active or passive).

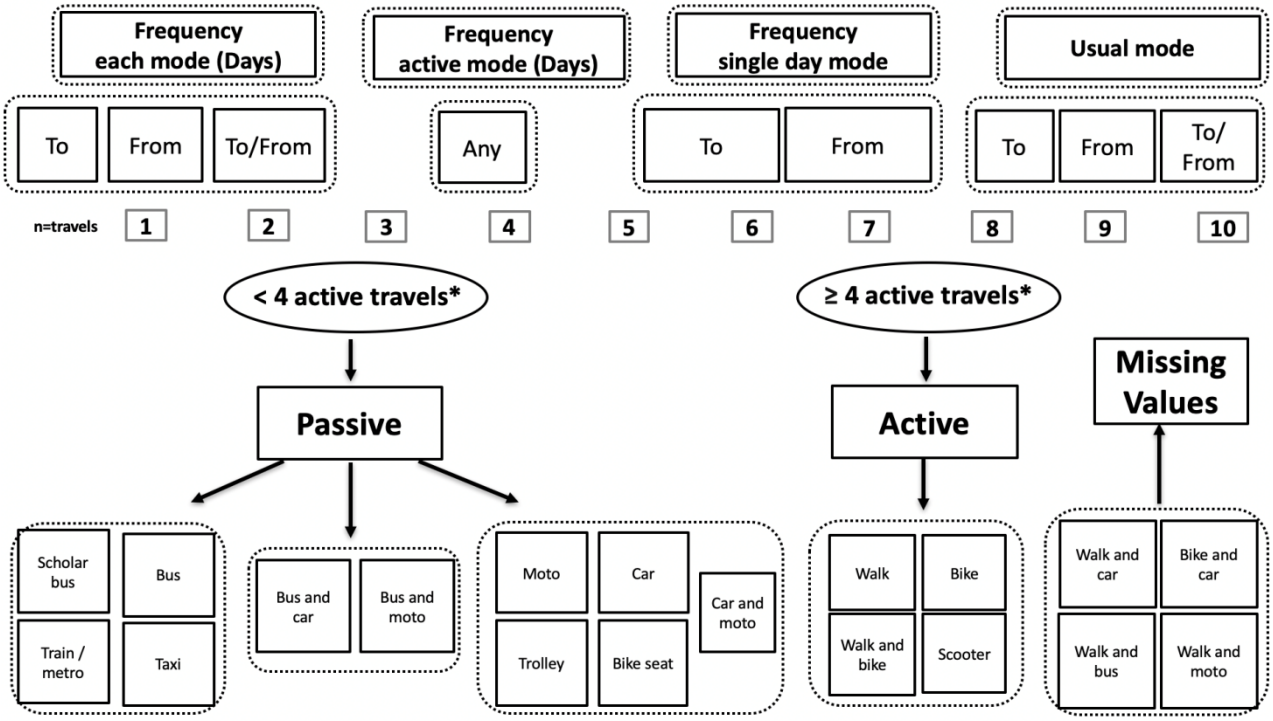

Figure 2. Categorization of the modes of commuting to/from school into active and passive commuting.
*The total amount of possible active travels is 10 travels/week.

The response options were categorized as "active" if they commuted using active modes: 1) usual active commuting during a week, 2) at least two full days (or four travels to and from school) commuting actively during a week (Chillón et al., 2012), or 3) at least one of the two usual daily travels going or coming back from school commuting actively (Chillón et al., 2009). Participants were categorized as "passive" if they commuted using passive modes: 1) usual passive commuting during a week, 2) at least four full days (or eight travels to and from school) commuting passively, 3) at least seven daily travels (go to school and come back from school) commuting passively. A final variable was created

for each category of mode of commuting: "active (all)" was composed by children and adolescents who actively commute to school, actively commute from school and actively commute to/from school; "passive (all)" was composed by children and adolescents who passively commute to school, passively commute from school and passively commute to/from school.

Time of commuting between home and school

The time of commuting between home and school was assessed in the 16 studies using two types of response options: a) an open answer with the exact number of minutes or b) a multiple-choice answer with several ranked time-periods increasing by 3, 5, 10 or 15 minutes. Regarding the response options, were categorized as "<15 min" if they commuted to school and spent less than 15 minutes and as "≥15 min" if they commuted to school and spent 15 minutes or more (Chillón et al., 2009).

Sociodemographic characteristics

The survey years were collected in each individual study. After joining all of them, the studies were classified into groups of two years, creating a categorized variable in this way: 2010-2011, 2012-2013, 2014-2015, and 2016-2017. Age and gender of the participants were reported.

City characteristics

Density information was obtained through Ministry of Finance and Public Administration of Spain, using the population density data of the Spanish municipalities that participated. The Population density was the number of inhabitants/area in km^2, expressed in inhabitants per square kilometer (hab / km^2).

The locality was considered rural when it has less than 10,000 inhabitants, and urban with more than 10,000 people live (Chillón et al., 2009).

The city income was assessed in the 28 studies using information of the year of the study about Tax Agency Spanish Public.

Statistical analysis

Descriptive statistics were reported for age, gender, ACS, time of commuting between home to school, density, city income, place of residence and survey year. Means and standard deviations were reported for continuous variables, and Frequencies and percentages were reported for categorical variables. To analyze the P-trend of each variable by survey year, one-way analysis of variance for continuous variables and chi squared for categorical variables were performed.

As the sampling frame of participants was based on cities, adjusted relationships between ACS and survey year were assessed using multilevel logistic regressions. In this analysis, participants (level 1) were nested in cities (level 2). ACS, survey years, age and time of commuting between home and school were included at the level 1; density, city income and rural/urban were included at the level 2. Testing the good of fitness of the model, the multilevel model fits better without these variables from the level 2. The multilevel logistic regression models were fitted and conducted separately for children and adolescents, were ACS was entered into the models as the dependent variable and the survey year as independent variable. Age was included as covariates.

Database management were performed using IBM SPSS Statistics 22.0 statistical package. The analyses were performed using STATA v.13 (*Stata Corp: 110th edition College Station, TX: Stata Corp LP; 2009*, n.d.) and statistical significance was set at $p<0.05$.

Results

Descriptive characteristics of the participants are shown in Table 2. Adolescents who lived on cities with more density, had a greater city income and spent more time for commuting to school, than children (all, $p<0.001$). Descriptive characteristics of the variables by survey years are shown in Table 3. Children and Adolescents who lived on cities with unstable density, have an unstable city income and ACS around the years (all, $p<0.001$).

The percentage of ACS by survey year, separately by age group (i.e. children and adolescents), is described in Figure 3.

The results of multilevel logistic regression between ACS with survey years, controlled by age, clustered by children and adolescents are shown in Table 4. In children, no association between ACS and survey year has been found. Adolescents were more likely to commute actively in 2012-2013 than in 2016-2017 (OR: 1.30, 95% CI: 1.06 – 1.58, $p\leq0.011$).

Discussion

This study explored the changes in the mode of commuting to/from school between 2010 and 2017 in Spanish children and adolescents. We observed that the rates of ACS in Spanish children and adolescents did not show a significant and clear tendency in the period 2010-2017, except a punctual increase in adolescents in 2012-2013. However, it is observed a general progressive increase of the rates of ACS along the period 2010-2017.

In the scientific literature, there are no studies reporting changes in children and adolescents after 2010 to confront the current results. Previous studies focused in children reported a decrease in the rates of ACS in the periods of 1994 and 2005 in Switzerland (Grize et al., 2010), in 2004-2008 in New Zealand (Hinckson, Garrett & Duncan, 2011) and in the period from 2004-2010 in Australia (Meron et al., 2011). On the other hand, previous studies focused in adolescents reported a decrease in the rates of ACS in the periods of 1969-2001 in the USA (McDonald, 2007) and between 2004 and 2009 in Vietnam (Trang, Hong & Dibley, 2012). This general decreased trend observed in the previous studies in children and adolescents is not according to our results. In the present study, the rates of ACS in Spanish children and adolescents showed a flat trend in the period 2010-2017.

Regarding the previous results in children and adolescents, the fact of not reporting a decrease in the rates of ACS in the last recent years for children and adolescents and, on the contrary, showing a general stability of the rates of ACS along the years, maybe a promising result. This flat trend may reflect the changes that Spanish society had adopted into potentially more healthy and sustainable behaviors among the population, attenuating the logical descent trend. We may find different reasons to understand this hypothesis. Firstly, the previous studies in children and adolescents compared a longer period of years than the seven years used in the current study. Secondly, a relevant socioeconomic event may have influence on this trend that requires to be explained. In Spain, there was a financial crisis between 2008-2014 that occurred partially when these data were obtained (Mañas, 2011) and, there is evidence with cross-sectional data that in Spain, adolescents from high socio-economic families had lower levels of ACS, compared with their peers from low socio-economic families (Chillón et al., 2009). Thirdly, different international studies have explained that the decreased trend in ACS might be due to changes in rising automobile ownership (U.S. Department of Transportation. Licensed drivers, population, and motor vehicles. Washington, DC: U.S. Department of Transportation, 2003). In fact,

attending to Spanish Directorate General of Traffic (DGT), the numbers of registered vehicles have been randomly changing in the period studied. In 2010-2011 was around 81,000, in 2012-2013 was around 72,000, in 2014-2015 was around 89,000 and in 2016-2017 was around 135,000. And, fourthly, the price of gasoline and diesel also have been arbitrarily change in the period 2010-2017 in Spain according to Spanish Ministry for Ecological Transition (https://www.mincotur.gob.es/). Perhaps, the population may more or less use of the car depending on the price of fuel. These reasons could be explained the flat trend.

This flat tendency in rates of ACS in children and adolescents might be an answer to the recent concern related to healthy and environmental issues in our society, and the families are changing into more healthy and sustainable behaviors, such as healthy food, practice physical activity and less use of the car (Pérez et al., 2017). We may speculate that the high number of interventions targeted to promote ACS carried out in Spain in the last years have had a positive influence. In addition, the national educational law (Organic law 08/2013) launched in 2013 included as a novel content to promote active commuting within educational curriculum. For example, the STARS Project pretends to empower and reward schools that promote sustainable and safe commuting among their students, including both walking or cycling and it started in 2016 and it continues nowadays in a big number of schools (121 primary and 73 secondary schools) from Spain. Moreover, the Traffic Snake Game originating in Belgium and Spain since 2014, encourage children, their parents and teachers to use forms of sustainable mobility when traveling to school, that is, riding, cycling, using public transport or sharing the car among several. Actually, it continues in 226 primary schools. Finally, as an example, the researcher Villa-González et al. (2017) developed an intervention program for 6 months focused on increasing the level of active commuting to school in school-age children of Southern Spain in the academic year 2011/2012. Regarding this increased number of interventions to promote ACS, perhaps the future trend could cease to be flat and present a promising and positive increase in the rates of ACS along the next decades.

In order to identify the overall patterns of ACS in a worldwide view, some interesting data are provided regarding that the prevalence of active commuting varies in each country and different percentages can be observed. A percentage of 58-65% Spanish children were active commuters to school in the period of 2010-2017; however, the proportion of ACS in other countries ranged from less than 11% in United States (Kontou et al., 2020) to 53% in Europe and Australia (A. H. K. 2018; Pavelka et al., 2017) or to

30% in New Zealand (Smith et al., 2018). On the other hand, a percentage of 55-66% Spanish adolescents were active commuters to school in the period of 2010-207; however, the the proportion of ACS ranged from less than 33% in United States (Kontou et al., 2020) to 40% in Europe (Tyler et al., 2016), 28-45% in Australia (A. H. K. 2018), 31% in New Zealand (Smith et al., 2018) or 20-70% in Asia (Uddin, R., Mandic, S., & Khan, A; 2019).

The main strength of this work is to provide a first diagnosis about how the patterns of mode of commuting to school in Spanish children and adolescents, compiling data from a high number of localities all around Spain and, furthermore, these patterns have been studied over the period 2010-2017 that allowed us to analyze the changes in the mode of ACS covering a period of time of 8 years. The main limitation is that the sample recruitment and the report of the mode of commuting in each study was different: the mode of commuting to and/or from school was assessed using different questions in the original studies and the procedure of data collection varies too. Additionally, the number of participants per every year was unbalanced. However, the systematic and double-checked process followed to merge the studies and the different questions used in each study to assess the ACS, ensure accurate data and appropriate analysis of these data.

Future studies should attend the trend observed in its country and analyze the potential reasons of increasing or decreasing to ensure the efficiency of intervention programs. Further interventions and promotion policies are needed in order to increase ACS in Spanish children and adolescents. Schools Interventions that guarantee the sustainability of the intervention are necessary, such as, introduce the intervention in the educational curriculum, leave material in the school for possible future application or deliver health recommendations to students. Additionally, given that parents are the decision makers on their children's mode of commuting (Ding et al., 2012; O'Connor & Brown, 2013), it is very important to work with parental perceptions of the environment, such as, focus group to analyze the barriers and to develop collaborative solutions, if we want that their children go to school actively. Moreover, we have to work with Spanish adolescents and for example, setting routes through the neighborhood and reduce the distance from home to school. We think that the greater the number of times an adolescent completes the same route, the greater the automation is and the lower the perception of distance is. Finally, for future studies, it should be interesting to use a single valid and reliable questionnaire model for data collection (Chillón et al., 2017).

Conclusion

In the period 2010-2017, the rates of ACS in children and adolescents have remained stable, without a clear tendency of change along the period 2010-2017. There was an absence of a decreased rate of ACS in the last recent years, reflecting the changes that Spanish society are acquiring into more healthy and sustainable behaviors. We hopefully are begun to see the positive effect of the interventions to promote active commuting to school in Spain. Since ACS to school is an important health behavior in young people, policy interventions, public authorities in the fields of education, and city planning should try to implement initiatives to keep this positive trend.

Acknowledgements

We acknowledge the effort and collaboration of the members of the Spanish research centers and local/regional public institutions who collaborate in this study.

Funding

This study was supported by the Spanish Ministry of Economy, Industry and Competitiveness and the European Regional Development Fund (DEP2016-75598-R, MINECO/FEDER, UE), and Spanish Ministry of Education and Vocational Training (FPU17/03934). Additionally, this study has been partially funded by the University of Granada, Plan Propio de Investigación 2016, Excellence actions: Units of Excellence; Unit of Excellence on Exercise and Health (UCEES), and by the Junta de Andalucía, Consejería de Conocimiento, Investigación y Universidades, European Regional Development Fund (ERDF), ref. SOMM17/6107/UGR. This study is part of a PhD thesis conducted in the Biomedicine Doctoral Studies program of the University of Granada, Spain.

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Table 2. Descriptive characteristics of the study participants.

	Children	Adolescents
	n=17617	n=17876
Age ($\bar{X}$±SD)	8.93 ± 1.68 [a]	14.15 ± 1.58 [a]
Female N (%)	8904 (50.5) [a]	8782 (49.1) [a]
ACS N (%)	10675 (60.6)	10760 (60.2)
<15 min N (%)	11482 (84.3) [a]	6758 (73.4) [a]
Density ($\bar{X}$±SD)	3933.32 ± 6055.7 [a]	4286.38 ± 6100.96 [a]
City income($\bar{X}$±SD)	21136.12 ± 5672.30 [a]	21800.32 ± 10086.04 [a]
Urban	14810 (84.1)	15162 (84.8)

a; difference between children and adolescents (p<0.01)
ACS= Active commuting to school.
SD= Standard deviation. $\bar{X}$ = mean.

Table 3. Descriptive characteristics of the study participants by survey year.

Children	2010/2011 n=930	2012/2013 n=3950	2014/2015 n=4160	2016/2017 n=7285	P (Trend)
Age ($\bar{X}$±SD)	8.95 ± 1.57	9.16 ± 1.80	8.82 ± 1.66	9.05 ± 1.72	< **0.001**
Female N (%)	2043 (51.1)	1489 (50.8)	4448 (50.4)	924 (50.1)	0.864
ACS					
All N (%)	2488 (62.1)	1926 (65.6)	5186 (58.7)	1075 (58.2)	< **0.001**
Female N (%)	1276 (62.2)	960 (64.47)	2559 (57.5)	543 (58.7)	< **0.001**
<15 min N (%)	2984 (87.6)	1080 (19.5)	6727 (86.8)	691 (61.6)	< **0.001**
Density ($\bar{X}$±SD)	12016.53 ± 1.6448.73	1051.07 ± 1353.08	1028.97 ± 2959.18	4427.24 ± 4809.73	< **0.001**
City income ($\bar{X}$±SD)	22817.84 ± 2850.498	20886.61 ± 6081.26	20669.48 ± 6298.83	20079.99 ± 5752.71	< **0.001**
Urban N (%)	4004 (100.0)	2693 (91.7)	6484 (73.4)	1629 (88.2)	< **0.001**
Adolescents	n=3547	n=4791	n=9072	n=7986	
Age ($\bar{X}$±SD)	14.26 ± 1.70	14.38 ± 1.41	13.56 ± 1.48	14.32 ± 1.93	< **0.001**
Female N (%)	2087 (48.2)	3765 (48.8)	2243 (49.4)	687 (53.3)	< **0.014**
ACS					
All N (%)	2603 (60.1)	4776 (61.9)	2526 (55.6)	855 (66.2)	< **0.001**
Female N (%)	1220 (58.5)	2330 (61.9)	1232 (54.9)	450 (65.5)	< **0.001**
<15 min N (%)	2304 (71.7)	1753 (77.7)	2083 (75.0)	618 (64.4)	< **0.001**
Density ($\bar{X}$±SD)	12541.32 ± 5659.53	1103.18 ± 1311.33	1651.18 ± 3452.25	3386.08 ± 5450.07	< **0.001**
City income($\bar{X}$±SD)	25486.73 ± 2476.62	18907.31 ± 8513.62	22777.76 ± 13607.04	23286.93 ± 14236.53	< **0.001**
Urban N (%)	4329 (100.0)	6010 (77.9)	3161 (78.4)	1262 (97.9)	< **0.001**

ACS= Active commuting to school.
SD= Standard deviation. $\bar{X}$ = mean.

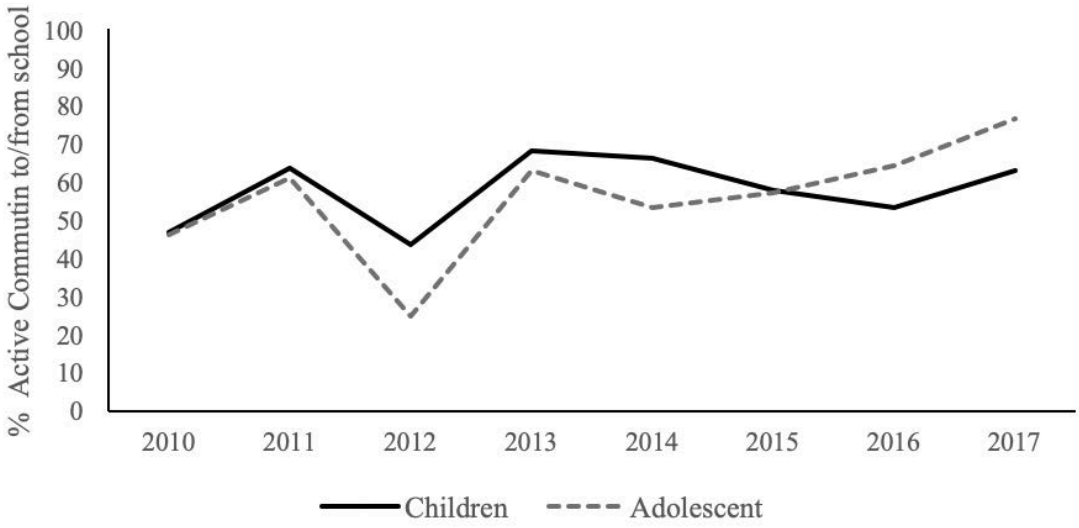

Figure 3. Percentage of ACS of children and adolescents by survey year.

Table 4. Odds ratios of active commuting to school with survey years for children and adolescents adjusting by age.

CHILDREN (n=17,617)	OR	95% CI	P
Survey years			
2016/2017 (n=1,846)	1	Reference	
2014/2015 (n=8,833)	1.03	0.86 - 1.25	0.717
2012/2013 (n=2,934)	0.91	0.75 - 1.11	0.363
2010/2011 (n=4,004)	0.86	0.71 - 1.04	0.116
Age	1.03	1.01 - 1.07	**0.004**
ADOLESCENTS (n=17,876)	OR	95% CI	P
Survey years			
2016/2017 (n=1,290)	1	Reference	
2014/2015 (n=4,543)	0.84	0.66 - 1.05	0.122
2012/2013 (n=7,714)	1.30	1.06 - 1.58	**0.011**
2010/2011 (n=1,429)	0.85	0.70 - 1.05	0.145
Age	0.99	0.96 - 1.00	0.188

OR= Odd Ratio. IC= Confidence Interval

Additional file

Table 1. Description of the main characteristics of each study included.

Resesrch center or Local/Regional Public institution	Collected Data (year)	Children (sample)	Adolescents (sample)
Agenda21. RC	2010	297	
Agenda21. RC	2010		338
UP&DOWN Study Group. RC	2011	552	928
University of Valencia. RC	2011		153
Barcelona Institute of Regional and Metropolitan Studies. RC	2011	2,483	2,910
University of Granada. RC	2011	672	
Torrelodones Council / GEA21. LRPI	2012	144	261
University of Granada. RC	2012	157	
University of Jaen. RC	2013		986
University of Granada. RC	2013	1,410	5,455
University of Zaragoza. RC	2013		1,012
University of Castilla La Mancha. RC	2013	455	
Zaragoza Council / Camino Escolar. LRPI	2013-2015	1,419	
IES Coruxo. LRPI	2014		97
University of Granada. RC	2014	83	
University of the Balear Island. RC	2014	592	1,374
La Biciclante. LRPI	2015		108
University of Granada. RC	2015	102	1
La ciclería. LRPI	2015	84	23
University of Valencia. RC	2015	198	111
University of Castilla La Mancha. RC	2015	6,731	2,363
University of Jaume I. LRPI	2015-2016		257
Generalitat Cataluña. LRPI	2015-2016	787	549
University of Granada. RC	2016	379	746
Laboratorio Auguria. RC	2016	175	0
Autonomous University of Barcelona. RC	2017	758	
University of the Balear Island. RC	2017	139	49
University of Zaragoza. RC	2017		155
Total 28	2010-2017	17,617	17,876

When the name of the study was inexistent, the name of the city where the RC/ GB that conducted that study was included

RC. Research center

LRPI. Local/Regional Public institution