

ORIGINAL ARTICLE

Higher independent mobility to school among adolescents: A secondary analysis using cross-sectional data between 2010 and 2017 in Spanish youth

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Abstract

Aim: To describe and to analyse the associations between independent mobility to school (IM) with gender and age in Spanish youth aged 6–18 years old from 2010 to 2017. Moreover, to study the changes in the rates of IM from 2010 to 2017 by gender and age.

Methods: Cross-sectional data were obtained from 11 Spanish studies. The study sample comprised 3460 children and 1523 adolescents. Logistic regressions models (IM with gender and age) and multilevel logistic regressions (IM with time period) were used.

Results: Boys had higher odds ratio (OR) of IM than girls in children (OR = 1.86; CI: 1.50–2.28, $p < 0.01$). Adolescents showed higher IM than children: 12–14 years old (OR: 6.30; CI: 1.65–23.97) and 14–16 years old (OR: 7.33; CI: 1.18–45.39) had higher IM than 6–8 years old for boys (all, $p < 0.05$). Moreover, 12–14 years old (OR: 4.23; CI: 1.01–17.81) had higher IM than 6–8 years old for girls ($p < 0.001$). IM was not associated with the time period.

Conclusion: The IM is higher in boys and in adolescents, highlighting the relevance to promote IM strategies targeting girls and children. In these strategies is essential the support of researchers, public health practitioners and families to achieve positive results.

KEYWORDS

autonomy, female, independent travel, travel behaviour, youth

1 | INTRODUCTION

Research has found evidence that meeting physical activity (PA) recommendations (i.e., 60 min of daily moderate-to-vigorous PA) leads to a range of physical and psychosocial health and well-being

benefits.¹ However, in Spain, 76.6% of children and youths between 11 and 17 years old are insufficiently physically active.² Since previous studies have shown that PA is a great benefit for health and well-being across the lifespan,¹ childhood is considered a very important period to develop a physically active lifestyle.

Abbreviations: IM, independent mobility to school; PA, physical activity.

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Independent mobility (IM) can be defined as a child's freedom to play in and get around their surroundings without parental supervision (e.g., going to school).³ Accumulating evidence suggests that children with higher levels of IM are more physically active than their counterparts with lower levels of IM.⁴ Moreover, IM whilst walking/cycling to school provides unsupervised opportunities for interaction with the neighbourhood environment.⁵ Beyond the physical benefits, IM also offers developmental and psychosocial benefits for children in the form of social interactions while travelling in groups (e.g., siblings and friends).⁶ In addition to the individual benefits, IM also provides positive associations with built environment, highlighting dead-end street, percentage of residential land and commercial land and, residential location type.⁷ Compared with neighbourhoods' safety, more IM during childhood in the neighbourhood offer a higher sense of safety; providing higher rates of IM among children.⁸ Furthermore, children who travel without parental supervision develop better perceptions about neighbourhood attributes, such as neighbourhood safety and fear of strangers.⁹

Despite these benefits, several studies have consistently demonstrated a decline in the prevalence of IM among young people worldwide in the last decades in Germany and England¹⁰ or Finland,¹¹ among others. Among European children, a rate of decline in IM ranged from 17% decrease in Germany between 1990 and 2010 to 22% decrease in England between 1971 and 2010.¹⁰ Less pronounced declines in IM rates have been reported among European adolescents ranging around 20% in Finland between 1990 and 2010.¹¹ The age at which children are granted IM has risen in comparison to previous generations. Various studies have consistently demonstrated that children's IM increased as they got older in Sweden, Germany, Japan or England, among others.¹⁰ In contrast, IM has diminished along the time particularly in countries like Denmark, Finland, Australia and Norway.¹² Identifying the correlates of IM may inform interventions to reverse this decline. Individual factors are crucial in a child's freedom to move and travel independently. These individual factors encompass factors such as a child's gender, age and confidence in their abilities.¹³ Additionally, a majority of studies examining children's IM have found that boys tend to have higher levels of IM in comparison to girls.¹⁴ Although various studies have examined correlates of IM internationally,^{10,11} studies targeting IM in Spanish young people are lacking. Under our knowledge, only one study in Spanish population has analysed the association between IM and age (through school grades), without taking into account the gender and using cross-sectional data.¹⁵ Concretely, the previous study reported how children in the 4th grade from Cádiz (Spain) showed lower IM than adolescents in the 7th and 10th grade of Madrid (Spain). Furthermore, there are no Spanish studies in the scientific evidence that examines the IM along the time using different year-periods.

Therefore, it is necessary to determine the association between IM and demographic factors in Spain. With this, it is intended to develop future interventions to promote the rates of IM in Spanish youth. Consequently, the aims of this study were: (1) to describe

Key Notes

- The association between independent mobility to school (IM) and demographic factors is sparsely explored in youth.
- Adolescents presented higher rates of IM than children. By gender, higher rates of IM in boys than girls in children were found, but not in adolescents.
- Promoting IM interventions targeting girls and children are needed, involving families in these interventions.

and to analyse the associations between IM with gender and age in Spanish students aged 6–18 years old, and (2) to study the changes in the rates of IM from 2010 to 2017 by gender and age.

2 | METHODS

2.1 | Study design

Cross-sectional data assessing IM from 11 different studies were analysed in this research. These data were collected between 2010 and 2017 from original studies conducted in Spain by research centres and local/regional public institutions, including Spanish children and adolescents. This study is part of the PACO Study ("Cycle and Walk to School Study") that focuses on designing and implementing interventions to promote active commuting to/from school among Spanish children and adolescents. The Medical Ethics Committee of University of Granada approved the PACO Study design, study protocols and informed consent procedure (case no. 162/CEIH/2016).

2.2 | Procedure

Spanish studies that collected IM were searched from an electronic database and from different congress and conferences carried out in Spain. Then, two researchers contacted 20 different Spanish research centres and local/regional public institutions inviting them by email to participate in the current study. All 20 invited Spanish research centres and local/regional public institutions agreed to participate and provided a total of 34 studies. From them, only 11 studies met the following inclusion criteria: (1) the study had to use a questionnaire for data collection to assess all variables, (2) data had to be included in the study individually for each participant, (3) study provided data on gender, age, IM, school location and data collection date and, (4) study participants were aged between 6 and 18 years old. In addition, researchers collected information about population density and income of the school's localities.

Data from the 11 studies were merged into a database with a final sample size of 5916 children and adolescents. From this sample,

a total of 933 (16%) participants were excluded because of missing data on: gender ($n = 158$), age ($n = 198$), or IM ($n = 755$). The final sample size included a total of 4983 children and adolescents from 29 different Spanish school's localities; namely, 3460 children from 6 to <12 years old (50.1% girls) and 1523 adolescents from 12 to 18 years old (50.4% girls) from Spain. Description of the main characteristics and collecting dates of the 11 studies included are presented in the supplementary file Table S1.

2.3 | Study variables

2.3.1 | Sociodemographic characteristics

Participants' data included gender and age. The age of the children and adolescents was grouped 2 years apart: 6–7.99 years old ($n = 552$), 8–9.99 years old ($n = 1439$), 10–11.99 years old ($n = 1469$), 12–13.99 years old ($n = 768$), 14–15.99 years old ($n = 443$), and 16–18 years old ($n = 312$), according to other studies¹⁶ to provide more sensible results between ages.

The characteristics of the school location used in the current statistical analyses were population density and income. The population density (number of inhabitants per locality area in km²-inhabitants/km²-) was obtained from the Ministry of Finance and Public Administration of Spain, using the available data closest to the data collection year in each locality. The income of the data collection year was obtained from the Tax Agency Spanish Public (<https://www.agenciatributaria.es/>).

2.3.2 | Time

The year when data was collected was registered and the grouping of said years was defined as time period. The time period was grouped into 2-year periods: 2010–2011 ($n = 2255$), 2012–2013 ($n = 1171$), 2014–2015 ($n = 524$), and 2016–2017 ($n = 1033$), according to other studies¹⁷ to guarantee an homogeneous sample size in each period and to explore changes.

2.3.3 | Independent mobility to school

The IM was self-reported in the 11 studies and two different questions were used. The question used in nine studies was “Does an adult accompany you when you go to school?”; and two studies asked “Who do you usually go to school with?” The response options provided from the previous questions offered different modes of accompaniment that were categorised into accompanied by adults vs. IM. Participants who reported commuting accompanied by a parent, caregiver, and/or neighbour were categorised as accompanied by adults. Participants who reported commuting alone, with friends and/or brothers were categorised as IM.

2.3.4 | Statistical analysis

Descriptive statistics were reported for participants data (i.e., age, gender, time period and IM) and for schools' location data (i.e., population density and income), separately by age group. Means and standard deviations were reported for continuous variables, and frequencies and percentages were reported for categorical variables. The first objective was studied using a logistic regression model to analyse the associations between IM and gender-grouped children and adolescents. Additionally, to analyse the relationships between IM and each age group separately by gender, a logistic regressions model was used. IM was entered into the model as the dependent variable and gender and age group respectively were included as independent variables. Age, year, income and population density were included as covariates.

The second objective was addressed by analysing the association between IM and time period using multilevel logistic regressions. The participants (level 1) were nested in school's localities (level 2). IM, time period, age and gender were included at level 1; population density and income were included at level 2. After testing the goodness of fitness of the model, the multilevel model fitted better without the variables from the level 2 (i.e. population density and income). The multilevel logistic regression models were fitted and conducted separately for children and adolescents, and boys and girls, where IM was entered into the models as the dependent variable and the time period as the independent variable. Gender (except when analyses were clustered by gender) and age were included as covariates. All the analyses were performed using STATA v.13 and statistical significance was set at $p < 0.05$.

3 | RESULTS

Data from 3460 children (6 to 11.9 years old; 50.1% girls) and 1523 adolescents (12 to 18 years old; 50.4% girls) were analysed (see Table 1). About 20% of the children and 90% of the adolescents commuted to school independently. In children, 16.5% of boys and 10.5% of girls commuted independently, while in adolescents, 77.8% of boys and 78.3% of girls commuted independently. Rates of IM across the six age groups ranged between 2% and 22% in 6–12 years old and between 68% and 88% in 12–18 years old.

Regarding the association between IM and gender (see Figure 1), those children boys are twice more likely to commute independently to school than children girls (OR = 1.86, CI: 1.50–2.28, $p < 0.01$). No differences between boys and girls were found among adolescents ($p > 0.05$).

The associations between IM with age groups, clustered by gender, are shown in Figure 2. Boys were more likely to commute independently in 12–14 years old (OR: 6.30; CI: 1.65–23.97), and in 14–16 years old (OR: 7.33; CI: 1.18–45.39) than boys in 6–8 years old (all, $p < 0.05$). Girls were more likely to commute independently in 12–14 years old (OR: 4.23; CI: 1.01–17.81) than girls in 6–8 years old ($p < 0.001$).

TABLE 1 Sociodemographic characteristics, time period, independent mobility to school, population density and income between children and adolescents.

	All <i>n</i> = 4983	Children <i>n</i> = 3460			<i>p</i> (Trend)	Adolescents <i>n</i> = 1523			<i>p</i> (Trend)
		6–7.99 <i>y</i> ^a <i>n</i> = 552	8–9.99 <i>y</i> ^a <i>n</i> = 1439	10–11.99 <i>y</i> ^a <i>n</i> = 1469		12–13.99 <i>y</i> ^a <i>n</i> = 768	14–15.99 <i>y</i> ^a <i>n</i> = 443	16–18 <i>y</i> ^a <i>n</i> = 312	
Age ($\bar{X}^b \pm SD^c$)	10.85 ± 2.57	7.16 ± 0.47	8.99 ± 0.43	10.89 ± 0.54	<0.001	12.27 ± 0.47	14.70 ± 0.45	16.85 ± 0.78	<0.001
Gender									
Boys [<i>n</i> (%)]	2481 (49.9)	388 (54.8)	715 (50.3)	709 (48.5)	0.035	388 (50.5)	229 (51.1)	138 (45.2)	0.099
Girls [<i>n</i> (%)]	2502 (50.1)	380 (45.2)	724 (49.7)	760 (51.5)		380 (49.5)	214 (48.9)	174 (54.8)	
Time period									
2010–2011 [<i>n</i> (%)]	2255 (41.9)	154 (27.8)	789 (54.8)	442 (25.4)	<0.001	465 (63.3)	283 (65.5)	122 (39.2)	<0.001
2012–2013 [<i>n</i> (%)]	1171 (19.8)	175 (31.5)	340 (23.6)	395 (21.4)		128 (15.5)	118 (25.4)	15 (4.6)	
2014–2015 [<i>n</i> (%)]	524 (19.8)	n.a. ^d	n.a. ^d	282 (32.5)		174 (21.1)	42 (9.1)	26 (8.1)	
2016–2017 [<i>n</i> (%)]	1033 (18.5)	223 (40.7)	310 (21.6)	350 (20.7)		1 (0.1)	n.a. ^d	149 (47.1)	
IM ^d [<i>n</i> (%)]	1657 (33.3)	13 (2.4)	135 (9.4)	318 (21.6)	<0.001	527 (68.6)	387 (87.3)	277 (88.8)	<0.001
Population density (median)	2379.61	2379.61	2379.61	1033.36	<0.001	5389.87	5389.87	324.37	<0.001
Income (median)	22358	21751	20861	22358	0.002	29400	29400	21830	<0.001

^a= years old.

^b= mean.

^c= standard deviation.

^d= independent mobility to school.

The odds ratio of IM along the time period 2010–2017, for children and adolescents and boys and girls, is described in Table 2. IM was not associated with the time period (all, *p* > 0.05).

4 | DISCUSSION

This study analysed the association between IM with gender and age in Spanish children and adolescents, using cross-sectional data

between 2010 and 2017 from 11 studies. Overall, this study indicates higher odds ratio of IM in boys than girls in children, but not in adolescents, and higher odds ratio of IM in adolescents than in children. The rates of IM in Spanish children and adolescents did not change significantly during the 2010–2017 period.

Globally, the prevalence of IM varies across countries ranging from 3% to 45% in children¹⁰ and from 25% to 65% in adolescents.^{11,18} In the current study, 20% Spanish children and 90% Spanish adolescents commuted independently during the 2010–2017 period. In

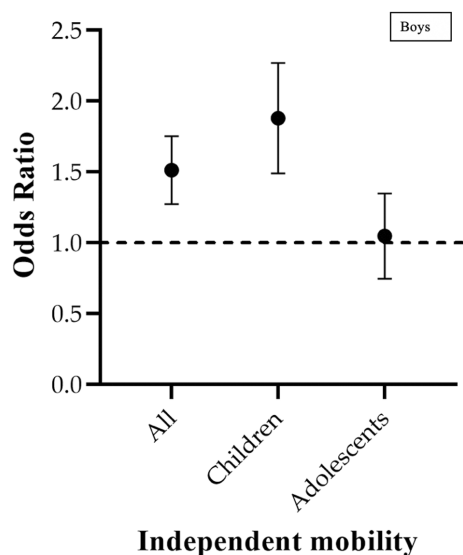


FIGURE 1 Association between independent mobility to school with gender by children and adolescents. The reference (OR = 1) is girls for the three OR values.

children, this prevalence is consistent with other recent studies conducted in other Spanish cities.¹⁹ Compared to the rest of the world, the prevalence of IM in children was slightly lower than that found in Germany and England¹⁰ and in adolescents the prevalence of IM was slightly higher than that found in Finland and Asia.^{11,18} Available evidence suggests a wide range of variables such as age, gender, family background, socioeconomic status and the structure of their neighbourhoods, as important individual, social and environmental factors that influence IM in children and adolescents.²⁰ These differences may contribute to cross-country variations in the prevalence of IM among children and adolescents observed in this and other studies.^{10,11,18} However, caution is required in making direct comparisons given the different measures used in these studies to assess IM. Interventions should be adapted to each context when aiming to increase IM as a public health strategy to facilitate increased PA among Spanish children and adolescents.

In the present study, boys had a higher odds ratio of IM than girls in children, but not in adolescents. In terms of gender, most studies show higher IM in boys than in girls.¹⁴ In some countries, issues such as the social construction of girls' identities as "weaker" or "in danger", and their freedom to commute in their neighbourhood or city have been questioned.²¹ The apparent gender difference may stem from early childhood, where boys are encouraged to be independent and take risks, and girls are taught to be cautious.²¹ However, these patterns may be more nuanced. Hillman et al. (1990) found that girls had less freedom because of stranger danger and fear of molestation, but were seen as more sensible, responsible and able to manage their own safety. In contrast, boys were considered to be 'risk takers' and could easily be led by their peers into making irrational decisions. Added to it, several studies surveying children suggested that vulnerability to strangers' harm is

more significant for children, particularly for girls.⁸ However, these gender differences were not found in the adolescence in the current study. It might be due to the interactions between age, gender and safety concerns. The fact of not having differences by gender in the percentage of IM in adolescents, maybe a promising result and it may reflect the changes that Spanish society had adopted from a coeducational perspective to overcome sexist stereotypes and strengthen egalitarian relationships.²² In the back of this hypothesis, it could be thanks to the different interventions in primary and secondary education to promote coeducation and reduce violence carried out in Spain in the last years²³ and, to the collaboration of public institutions, such as Spanish Women's Institute. Added to it, the Organic law 08/2013 includes the subject of gender equality in the educational curriculum. Given that, gender-sensitised interventions may be required to support girls in having more IM during the elementary school years.

In terms of age, trends were consistent with international reports. Previous research has reported that IM increases as children get older.^{10,13,15} Regarding these results in Spain, we could attribute this finding to several reasons. At younger ages, children could begin to take the decision to travel to school without supervision²⁴ but nevertheless, parents determine the distance that children are allowed to travel without supervision.²⁵ Moreover, perceptions of the neighbourhood by parents could determinate children's IM.²⁶ In fact, several studies demonstrated how the perceptions of traffic safety and crime-related safety in the same environment were different between adolescents and parents.²⁷ Added to it, families who believed their offspring were capable of being independent and its benefits, had children who had higher rates of IM.⁶ Furthermore, the start of adolescence (12 years old) coincides with the change from primary to secondary school in the Spanish educational system, which usually implies a change of the route to school, new friendships and involvement in different activities that promote greater independence,²⁸ thus adolescents become more autonomous. Adolescents may achieve more maturity and competence in their own abilities which may help increase their IM.²⁹ It may be that IM interventions should target 10–12 years old children to obtain greater effects – this age has relatively lower IM than later years in Spain and initiatives could focus on addressing the safety concerns parents may have and preparing children with the skills and confidence to travel independently from their parents.

In the current study, there were no significant changes in IM rates among Spanish children and adolescents during the 2010–2017 period. Opposite results were found previously in several studies, which have reported a decline in IM rates among children and adolescents from 1971 to 2010.^{10,11,18} The absence of changes in IM rates in Spain showed in the current study could be reflect the policies that Spanish society had adopted into potentiate more active and independent behaviours in the population. The adoption of more friendly environment perceptions from Spanish families and a better social construction about child's gender, could help to reduce the decrease of the IM rates.

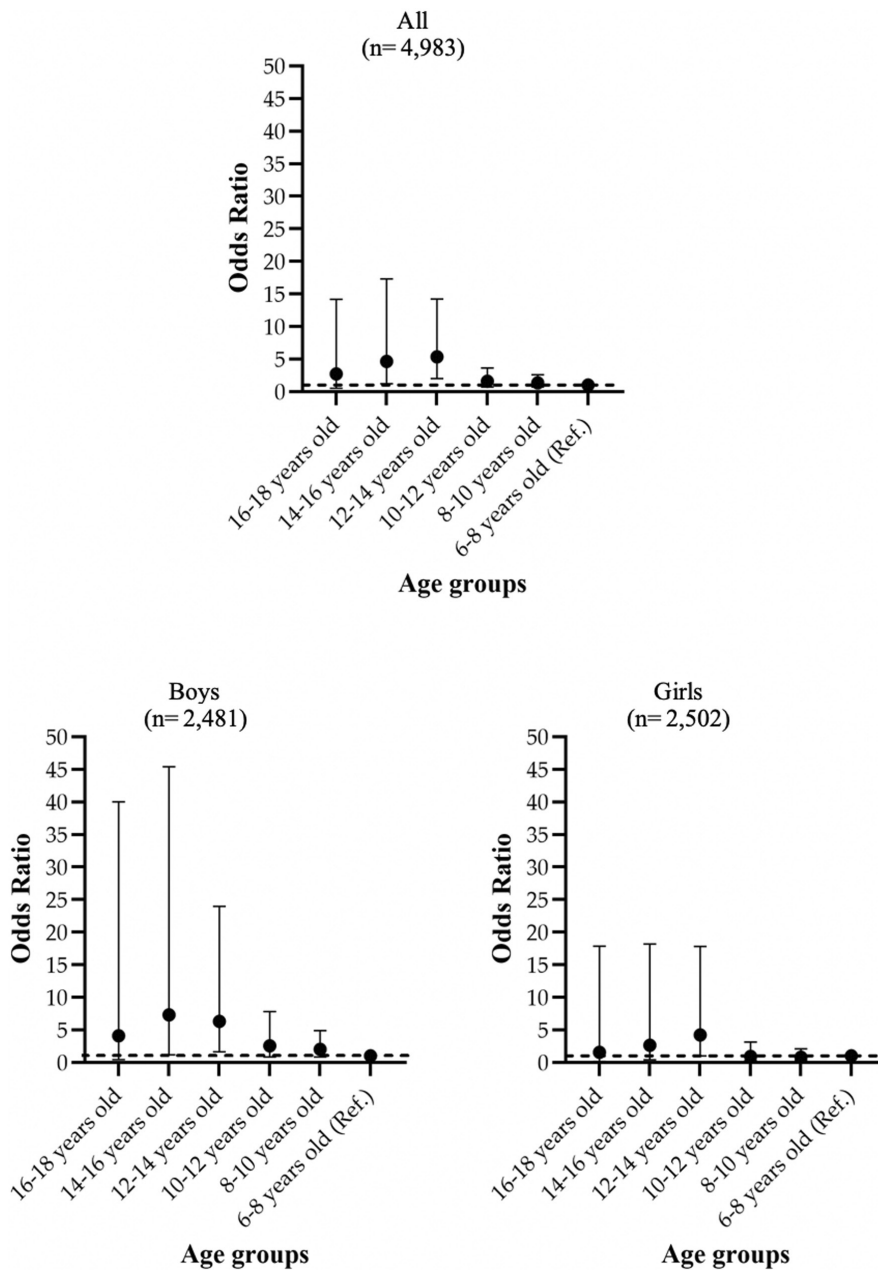


FIGURE 2 Association between independent mobility to school with age group by gender. There were significant differences for all, boys and girls in 12–14 years old (all, $p < 0.05$) and for all and boys in 14–16 years old (all, $p < 0.05$).

4.1 | Strengths and limitations

The main strength of this work is to provide a first study about how IM is related to gender and age in Spanish children and adolescents, compiling data from many localities across Spain and, across time (2010–2017). The main limitations of this study are the use of data from non-representative samples and the lack of home-to-school distance or time data. Furthermore, the sample recruitment and the report of the IM in each study were different: IM was assessed using different questions in the original studies and the procedure of data collection varies too. Strong partnerships between researchers, families, public health practitioners, policy-makers and communities aiming to increase IM are necessary to ensure positive results in the long term.

4.2 | Perspective of future research

When future researchers implementing interventions to promote IM levels among children and adolescents, some considerations should be taken into account. In children the differences in gender suggest us to work on coeducation and safety issues, with special attention on girls. In addition, different approaches should be more needed to increase IM according to the children age than the adolescents age. Given the important role that parents have with regards to their children's IM, it would be advisable to involve parents in the interventions. In addition, it is urgent to better understand perceptions of children's safety, and the social and ecological forces influencing those perceptions. Future studies should deepen the relationship between children's commuting choices and the consequences

TABLE 2 Analysis of multilevel logistic regression models testing associations between independent mobility to school and time period, clustered by gender and age.

	Time period			
	2016/2017	2014/2015	2012/2013	2010/2011
ALL (n = 4971)				
Odds ratio	1	0.96	0.14	1.46
95% confidence interval	Ref.	0.03–30.50	0.02–21.35	0.04–964.32
p Value		0.983	0.444	0.908
CHILDREN (n = 3459)				
Odds ratio	1	1.13	0.23	2.09
95% confidence interval	Ref.	0.02–78.88	0.05–97.65	0.01–561.64
p Value		0.953	0.637	0.856
ADOLESCENTS (n = 1512)				
Odds ratio	1	0.31	2.03	2.91
95% confidence interval	Ref.	0.01–64.60	0.03–546.37	0.09–364.32
p Value		0.669	0.830	0.664
BOYS (n = 2474)				
Odds ratio	1	2.45	0.30	5.38
95% confidence interval	Ref.	0.14–36.84	0.02–4.52	0.60–48.74
p Value		0.513	0.384	0.135
GIRLS (n = 2440)				
Odds ratio	1	1.14	0.40	4.92
95% confidence interval	Ref.	0.01–15.30	0.02–7.53	0.33–44.32
p Value		0.920	0.509	0.154

related to their well-being, so that parents and society understand its importance and there is a cultural shift supporting more active and independent children.

5 | CONCLUSION

In the period 2010–2017, the current study presents a higher odds ratio of IM in boys than girls in children, but not in adolescents; and there was higher odds ratio of IM in adolescents than in children. Additionally, the rates of IM in Spanish children and adolescents have remained stable over these years, reflecting the changes in Spanish society of more friendly environment perceptions and gender equality. In fact, it might begin to see some positive effects of the interventions to promote coeducation in secondary schools in Spain. Since IM to school is an important health behaviour for young people; policy interventions, public authorities in the fields of education, and city planning should implement initiatives to promote safety and friendly neighbourhoods for children and adolescents that support IM.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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