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Parental perceptions of barriers to active commuting to school in Spanish children and adolescents

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Background: Understanding parental barriers is crucial to promote active commuting to school since the parental perceptions influence how young people commute. This study examined parental barriers to active commuting to school among Spanish children and adolescents, and their association with their gender and the usual mode of commuting. **Methods:** Parents of children ($n = 628$) and parents of adolescents ($n = 151$) from Granada (Spain) completed a paper-based questionnaire about perceived parental barriers to active commuting to school and mode of commuting. Data were analyzed using the Chi-square test. **Results:** Among Spanish parents, the most common barriers reported by parents of children were traffic volume and dangerous intersections, whereas the most frequent barriers reported by parents of adolescents were distance to school and dangerous intersections. Compared to parents of children, a greater proportion of parents of adolescents reported distance to school and crime and smaller proportion reported traffic volume as barriers to active commuting to school. Among parents of children, crime was a more commonly reported as a barrier by parents of girls. Although some barriers reported by parents of passive commuters were similar for children and adolescents (such as distance to school and absence of a policeman at crosswalks), other barriers were specific to parents of children. **Conclusions:** The main parental barriers to active commuting in children were traffic volume and dangerous intersections whereas for adolescents were distance and dangerous intersections. Among Spanish parents, parental barriers to active commuting are influenced by children's age, gender and mode of commuting to school.

Introduction

The sedentary lifestyle and the lack of physical activity in children and adolescents[1] are a global health problem requiring a solution.[2] The World Health Organization[3] recognizes four different domains of physical activity including work/school physical activity, transport, household chores and leisure time activities. Both walking and cycling to school are related to higher physical activity levels in young people.[4] Cycling to school is also associated with a higher cardiorespiratory fitness in children and adolescents.[5] However, a decline in the rates of active commuting to school in children and adolescents has been observed in recent decades in USA[6] and Spain.[7]

The parental perception of the environment has been related to children's activity, such as playing outdoors,[8] or the overall physical activity.[9] Parental barriers such as distance to school and environmental safety in children or neighborhood safety in adolescents may hinder active commuting to school.[10] Several studies examining the associations between parents' perception and mode of commuting to school in children and adolescents have been conducted in USA[11] and Australia[12]; however, studies are currently lacking in Europe to capture a global understanding of the influence of parents perceived barriers.[13] Since the perceptions of the barriers to active commuting are context-specific (i.e., culture, geography, sociodemographic characteristics and policy), studies conducted in a specific context are essential for informing local policy development and interventions to promote active commuting to school.

Parental barriers to active commuting like traffic or perceived safety are influenced by children's age. In Melbourne, parents of older children (10–12 years) were less concerned about safety and, consequently, were more likely to let their children use active commuting modes compared to younger children.[14] Consistent with these findings, several studies reported that older children (9–12 years) were more likely to use active commuting to school than younger children.[9] Moreover, studies focused on how the parental barriers are associated with children's characteristics (i.e., gender, mode of commuting) are lacking. Better understanding of the parental barriers to active commuting to school with respect to child's age and gender will inform the design of future interventions to promote active commuting to school in children and adolescents.

The purpose of this study is two-fold: (1) to determine parental barriers to active commuting to school in Spanish children and adolescents, (2) and to examine the association of the parental perceived barriers with children and adolescents gender and usual mode of commuting to school.

Methods

Study design and participants

Parents of children ($n = 628$; children's age: 9–12 years, enrolled in primary school) and parents of adolescents ($n = 151$; adolescent's age: 12–16 years, enrolled in secondary school) from Granada (Spain) participated in this study. Data were collected between April 2014 and May 2015 as the first phase of the PACO (Pedalea

y Anda al Colegio) Project. The PACO Project examines active commuting to school in Spanish children and adolescents and aims to implement strategies with children and their families to promote active commuting to school. The Medical Ethics Committee of Hospital Virgen de las Nieves (Granada, Spain) approved the study design, study protocols and informed consent procedure (case no. 817).

Procedures

Parents from 9 schools from urban areas of Granada selected by convenience were invited to participate in this study. The research team contacted the headmaster of each school and parents of children and adolescents were invited by letter to complete a 20-min self-reported paper-based questionnaire.

The questionnaire contained sections on sociodemographic characteristics of parents and their children/adolescents, modes of commuting to and from school for their children/adolescents and parental barriers to active commuting.

Sociodemographic characteristics

Parents self-reported their sociodemographic characteristics (gender and highest education level of parents -primary or secondary school and university-), child's age and gender.

Mode of commuting to school

This 25 questionnaire has been proposed as one of the most appropriate measurement for asking about mode of commuting to school.[15] The mode of commuting to school was assessed using separate questions for travelling to and from school: ''*How does your child usually travel to school/come back from school?*'' Parents were asked to select one of the response categories (i.e. walking, cycling, car, motorcycle, bus, train and other) for each question. Children and adolescents were categorized as ''active commuters'' if parents reported that their child/adolescent walked or cycled to and/or from school and as ''passive commuters'' if their child/adolescent travelled to and from school by car, motorcycle, bus or train.

Parental barriers

Parental barriers were assessed using a question from the Safe Routes to School Program[16] that was adapted to the Spanish cultural context. The translated question was formulated as: ''*Which of the following situations affect your decision to not allow your child walk or bike to or from the school?*''. The question included 12 items referring to perceived parental barriers to active commuting to school, where parents could select one or more barriers related to safety (crime, absence of a policeman at crosswalks and absence of adults to walk with), traffic (traffic volume and speed), environment (dangerous intersections and no sidewalks or bike lanes), weather, distance (distance to school and time required to actively commuting to school) and convenience (after-school activities and parental convenience) that affect their decision to allow their children/adolescent to active commute to school. Based on the number of reported parental barriers (out of 12) participants were categorized into low (0 or 1 barrier), medium (2–4 barriers) and high number of barriers (5–12 barriers).

Statistical analysis

Demographic characteristics were analysed using descriptive statistics. Data are reported as mean ± SD for continuous variables and frequency (%) for categorical variables. Differences in parental perceived barriers in children versus adolescents, boys versus girls and active versus passive commuters were analysed using the Chi-square test by layers (different school). Differences between number of parental perceived barriers where analysed with t-test for independent samples. Analyses were performed using the PASW (v. 20.0 for Windows, Chicago, IL, USA), and the level of significance was set to $P < 0.05$.

Results

Surveyed parents were mostly females, with primary and secondary school education (table 1). Approximately half of surveyed parents reported that their children (49.2%) and adolescents (51.3%) used active modes of commuting to school (table 1).

Parental barriers were different for parents with children attending a primary school compared to parents of adolescents attending a secondary school (table 2). The most common barriers reported by parents of children were traffic volume and dangerous

Table 1 Sociodemographic characteristics of study participants

	Parents of children *n* = 628 *n* (%)	**Parents of adolescent *n* = 151 *n* (%)**	***P* values**
Gender	*n* = 597	*n* = 149	**0.009**
Male	135 (22.6)	49 (32.9)	
Female	462 (77.4)	100 (67.1)	
Father's Educational Level	*n* = 572	*n* = 127	0.173
Primary or secondary school	434 (75.9)	89 (70.1)	
University	138 (24.1)	38 (29.9)	
Mother's Educational Level	*n* = 572	*n* = 131	0.492
Primary or secondary school	389 (68)	85 (64.9)	
University	183 (32)	46 (35.1)	
Children's gender	*n* = 627	*n* = 151	0.066
Boys	318 (50.7)	64 (42.4)	
Girls	309 (49.3)	87 (57.6)	
Children's mode of commuting	*n* = 606	*n* = 151	0.636
Active	298 (49.2)	77 (51.3)	
Passive	308 (50.8)	73 (48.7)	

Table 2 Parental perceived barriers to active commuting to school

Barriers	**Parents of children *n* = 626 *n* (%)**	**Parents of adolescents *n* =149 *n* (%)**	***P* values**
Traffic			
Traffic volume	305 (48.7)	49 (32.9)	**0.000**
Speed of traffic	198 (31.6)	36 (24.4)	0.074
Safety			
Crime	179 (28.6)	55 (36.9)	**0.047**
Absence of a policeman at crosswalks	113 (18.1)	34 (22.8)	0.182
Absence of adults to walk with	150 (24.0)	29 (19.5)	0.242
Environment			
Dangerous intersections	281 (45.0)	59 (39.6)	0.236
No sidewalks or bike lanes	254 (40.6)	52 (34.9)	0.198
Distance			
Distance to school	232 (37.1)	75 (50.3)	**0.003**
Time required to active commuting to school	83 (13.3)	22 (14.8)	0.629
Weather			
Weather conditions	199 (31.8)	44 (29.7)	0.627
Convenience			
After-school activities	54 (8.6)	13 (8.7)	0.969
Parents convenience	15 (2.4)	3 (2.0)	N/A
Number of parental barriers to active commuting			
Low frequency	183 (29.3)	55 (37.2)	0.083
Medium frequency	255 (40.9)	47 (31.8)	
High frequency	186 (29.8)	46 (31.1)	
Average	3.30 ± 2.53	3.14 ± 2.69	0.484

Table 3 Parental perceived barriers to active commuting to school by gender and mode of commuting to school in children

Parents of children (*n* = 626)	Boys *n* = 318 *n* (%)	Girls *n* = 307 *n* (%)	*P* values	Active commuters *n* = 296 *n* (%)	Passive commuters *n*=308 *n* (%)	*P* values
Traffic						
Traffic volume	155 (48.7)	149 (48.5)	.959	134 (45.3)	159 (51.6)	0.118
Speed of traffic	109 (34.3)	88 (28.7)	.131	91 (30.7)	96 (31.2)	0.910
Safety						
Crime	77 (24.2)	102 (33.2)	**.013**	90 (30.4)	82 (26.6)	0.303
Absence of a policeman at crosswalks	61 (19.2)	51 (16.6)	.402	43 (14.5)	64 (20.8)	**0.044**
Absence of adults to walk with	73 (23.0)	76 (24.8)	.598	59 (19.9)	89 (28.9)	**0.010**
Environment						
Dangerous intersections	145 (45.6)	135 (44.1)	.710	129 (43.7)	141 (45.8)	0.613
No sidewalks or bike lanes	139 (43.8)	114 (37.1)	.104	108 (36.6)	138 (44.8)	**0.041**
Distance						
Distance to school	124 (39.0)	107 (34.9)	.284	72 (24.3)	152 (49.4)	**0.000**
Time required to active commuting to school	37 (11.6)	45 (14.7)	.263	27 (9.1)	54 (17.5)	**0.002**
Weather						
Weather conditions	109 (34.3)	89 (29.0)	.156	82 (27.7)	112 (36.4)	**0.023**
Convenience						
After-school activities	27 (8.5)	26 (8.5)	.992	22 (7.4)	30 (9.7)	0.312
Parents convenience	10 (3.1)	5 (1.6)	.216	2 (0.7)	12 (3.9)	N/A
Number of parental barriers to active commuting						
Low frequency	88 (27.8)	95 (31.0)	.631	105 (35.7)	71 (23.1)	**0.001**
Medium frequency	131 (41.3)	124 (40.5)		117 (39.8)	131 (42.5)	
High frequency	98 (30.9)	87 (28.4)		72 (24.5)	106 (34.4)	
Average (out of 12 barriers)	3.36 ± 2.46	3.22 ± 2.58	.497	2.92 ± 2.52	3.66 ± 2.46	**0.000**

intersections. The most frequent barriers reported by parents of adolescents were distance to school and dangerous intersections. There were significant differences between parents of children versus parents of adolescents in traffic volume, crime, and distance to school (all $P < 0.05$). Compared to parents of children, a greater proportion of parents of adolescents reported distance to school and crime and smaller proportion reported traffic volume as perceived barriers to active commuting to school.

Among parents of children, crime was more frequently reported as a barrier to active commuting to school by parents of girls compared to parents of boys ($P = 0.013$) (table 3). No other differences in parental barriers were observed for girls versus boys. Compared to the parents of passive commuters, a significantly lower proportion of parents of children who commuted actively to school perceived absence of a policeman at crosswalks, absence of adults to walk with, lack of sidewalks or bike lanes, distance to school, time required to active commuting to school and weather conditions as barriers to active commuting for their children (all $P < 0.05$). When the total number of reported barriers were compared, parents of active commuters perceived fewer barriers compared to the parents of passive commuters ($P = 0.001$).

Among parents of adolescents, no differences in parental barriers to active commuting were observed between parents of boys versus girls (table 4). Compared to the parents of passive commuters, a significantly lower proportion of parents of adolescents who commuted actively to school perceived distance to school and absence of a policeman at crosswalks as barriers to active commuting (both $P < 0.05$).

Discussion

The key findings from this study were: (1) among Spanish parents, the most common barriers reported by parents of children were traffic volume and dangerous intersections, whereas the most frequent barriers reported by parents of adolescents were distance to school and dangerous intersections; (2) compared to parents of children, a greater proportion of parents of adolescents reported distance to school and crime, and smaller proportion reported traffic volume as barriers to active commuting to school; (3) among parents of children, crime was a more commonly reported as a barrier by parents of girls versus parents of boys; (4) although some barriers reported by parents of passive commuters versus active commuters were similar for children and adolescents (such as distance to school and absence of a policeman at crosswalks), other barriers were specific to parents of children (absence of adults to walk with, no sidewalks or bike lanes, time required to active commuting to school and weather conditions). Taken together, these findings suggest that, among Spanish parents, parental barriers to active commuting are influenced by children's age, gender and mode of commuting to school.

The most common barriers reported by parents of children were traffic volume and dangerous intersections, whereas the most frequent barriers reported by parents of adolescents were distance to school and dangerous intersections. Traffic volume was reported as a barrier by half of the parents of children. Some studies found that children's active commuting depends on parental perceptions of the traffic and safety;[17] more specifically parents felt that walking to school is more dangerous because of the traffic than because of crime.[18] Consistent with these findings, presence of traffic lights was associated with the choice of the route to school in children in The Netherlands.[19] Traffic accidents, noise and air pollution exposure are some of the health risk of active commuting, but they are minor compared with the health benefits.[20]

Dangerous intersections were among most commonly reported parental barriers to active commuting to school for both children and adolescents in the present study. According to previous studies crossing a busy road is negatively associated with active commuting in children.[21] Improving road safety is one of the most important factors to increase active commuting in children.[22] However, safety is a very complex concept and may include diverse subjective components such as personal injury, harm from strangers, road safety and bullying.[23] Moreover, if parents perceived presence of people in their neighborhood, safe crosswalks and not many dead end streets, children had higher rates of active commuting to school.[24]

Table 4 Parental perceived barriers to active commuting to school by gender and mode of commuting to school in adolescents

Parents of adolescents (*n* = 149) *n* (%)	**Boys** *n* = 64 *n* (%)	**Girls** *n* = 85 *n* (%)	***P* values**	**Active commuter** *n* = 75 *n* (%)	**Passive commuters** *n* = 73 *n* (%)	***P* values**
Traffic						
Traffic volume	21 (32.8)	28 (32.9)	0.987	20 (26.7)	28 (38.4)	0.129
Speed of traffic	17 (26.6)	19 (22.4)	0.552	20 (26.7)	16 (21.6)	0.501
Safety						
Crime	21 (32.8)	34 (40.0)	0.368	28 (37.3)	27 (37.0)	0.965
Absence of a policeman at crosswalks	14 (21.9)	20 (23.5)	0.812	12 (16.0)	22 (30.1)	**0.041**
Absence of adults to walk with	8 (12.5)	21 (24.7)	0.062	11 (14.7)	18 (24.7)	0.126
Environment						
Dangerous intersections	24 (37.5)	35 (41.2)	0.650	29 (38.7)	30 (41.1)	0.763
No sidewalks or bike lanes	23 (35.9)	29 (34.1)	0.818	22 (29.3)	30 (41.1)	0.134
Distance						
Distance to school	31 (48.4)	44 (51.8)	0.688	28 (37.3)	47 (64.4)	**0.001**
Time required to active commuting to school	9 (14.1)	13 (15.3)	0.834	9 (12.0)	13 (17.8)	0.321
Weather						
Weather conditions	20 (31.7)	24 (28.2)	0.664	23 (31.1)	20 (27.4)	0.624
Convenience						
After-school activities	7 (10.9)	6 (7.1)	0.406	7 (9.3)	6 (8.2)	0.811
Parents convenience	2 (3.1)	1 (1.2)	N/A	2 (2.7)	1 (1.4)	N/A
Number of parental barriers to active commuting						
Low frequency	25 (39.7)	30 (35.3)	0.758	33 (44.6)	22 (30.1)	0.190
Medium frequency	18 (28.6)	29 (34.1)		21 (28.4)	25 (34.2)	
High frequency	20 (31.7)	26 (30.6)		20 (27.0)	26 (35.6)	
Average (out of 12 barriers)	3.03 ± 2.82	3.22 ± 2.60	0.670	2.77 ± 2.78	3.53 ± 2.57	0.086

Distance to school was perceived as a barrier to active commuting to school by third of the parents of children and half of the parents of adolescents. Distance was reported to be one of the most frequent barrier to active commuting in both children and adolescents from USA,[25] Australia[21] and New Zealand[26] as greater distances from home to school are associated with lower rates to active commuting.[27,28] Distance and dangerous intersections were previously reported as some of the most important barriers to active commuting to school among Spanish adolescents.[29] These findings are consistent with studies comparing adolescents' and parental barriers to active commuting in the USA, where parents and adolescents reported the similar barriers.[30]

Among parents of children, crime was a more commonly reported barrier by parents of girls versus parents of boys in the present study. Lower independent mobility for walking and cycling to school was previously reported in 10-12 years old Belgium girls compared to boys.[31] Previous studies reported that parental fear of strangers is one of the most important barrier to independent mobility in girls in Australia,[32] which is consistent with our results.

Although some barriers perceived by parents of passive commuters were similar for children and adolescents (such as distance to school and absence of a policeman at crosswalks), other barriers were specific to parents of children in the present study. Absence of adult supervision, absence of sidewalks or bike lanes, time required to actively commute to school and the weather were more frequently reported as barriers to active commuting in parents of children who are passive commuters versus those who use active modes of commuting to school. These findings suggest that interventions related to reducing the impact of distance to school[33] as well as presence of a policeman at crosswalks near school may be effective to minimize parental barriers to active commuting to school among Spanish children and adolescents. Additional interventions related to improving the pedestrian and cycling infrastructure and providing adult supervision (such as 'school walking bus' interventions) may be necessary to address parental barriers in parents of primary school children. Although, a more restrictive school choice policy could decrease distance to school, a previous study in Australia found no significant effect of the school choice policy on the active commuting to school in children.[34] The school location in relation to residential areas and major traffic routes are important in urban areas.[35] Therefore, it is important to locate schools within safe neighborhoods and within acceptable distance for active commuting for children and adolescents.[36]

The policy implications should be oriented to improve the parental perceptions of the environment and safety of active commuting to school. Since parents of passive commuters perceived a greater number of barriers compared to the parents of active commuters, it is essential to address parental barriers to increase the rates of active commuting to school. It is necessary to educated parents and children and change their perceptions of active communting because it was shown that changing distance or sidewalks only was not enough.[34] In primary schools, it is important to improve parental perceptions of safety of active commuting to school through different programs such as working with travel coordinators, walking school buses or safe routes to school.[37] In Spain it will be essential to reduce traffic volume and improve safety of intersections with specific intervention programs, such as built environment changes or provision of a policeman at crosswalks around primary schools. In adolescents, it is very important to improve parental safety perception and work with local governments and city councils addressing environmental policies that decrease the distance between secondary schools and residential areas and reconsider what constitutes a reasonable distance for active commuting to school. Therefore, it is crucial to increase the parental confidence in children's ability to active commute to school.[38] In addition, interventions aimed at reducing traffic volume around schools would address one of the key parental barriers to active commuting in children and will also reduce traffic congestion and reduce the air pollution exposure.[39]

Study limitations include self-reported data, limited reliability of the questions used for assessing parental barriers,[40] relatively small sample of parents of adolescents and limited generalizability of findings to other parts of Spain due to data collection in one city. Future studies should examine parental barriers to active commuting in other geographic areas of Spain and Europe and explore further the interaction between child's age, gender and other characteristics and parental barriers to active commuting.

In conclusion, perceived parental barriers to active commuting to school in Spanish children and adolescents were influenced by children's age, gender and mode of commuting to school. Parents of adolescents expressed more concerns about distance to school and crime and less concerns regarding the traffic volume compared to the parents of children. Crime was a more commonly reported parental barrier for girls versus boys. Although some barriers reported by parents of passive commuters were similar for children and adolescents, other barriers were specific to parents of children. Future interventions for promoting active transport to school focusing on parents should be targeting specific parental barriers for a particular age group of children, addressing parental concerns for safety of girls attending primary schools and minimizing perceived barriers of parents of passive commuters to school. Improving the pedestrian and cycling infrastructure and providing adult supervision may be necessary for addressing parental barriers to active commuting in primary school children.

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Conflicts of interest: None declared.

Key points

- Parental barriers determine active commuting to school
- Traffic volume and dangerous intersections are the main barriers for parents of children
- Distance to school is the most important barrier for parents of adolescents
- Parental barriers are influenced by children's age, gender and mode of commuting

References

1 Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act* 2010; 7:1–16.

2 World Health Organization. Inequalities in Young People's Health. *World Health* 2006;1–224.

3 World Health Organization. Global rcommentations on physical activity for health. 2010.

4 Chillón P, Ortega FB, Ruiz JR, et al. Active commuting and physical activity in adolescents from Europe: results from the HELENA study. *Pediatr Exerc Sci* 2011;23:207–17.

5 Andersen LB, Lawlor D. a, Cooper AR, et al. Physical fitness in relation to transport to school in adolescents: the Danish youth and sports study. *Scand J Med Sci Sports* 2009;19:406–11.

6 McDonald NC. Active transportation to school. Trends among U.S. schoolchildren, 1969-2001. *Am J Prev Med* 2007;32:509–16.

7 Chillón P, Martínez-Gómez D, Ortega FB, et al. Six-year trend in active commuting to school in Spanish adolescents. *The AVENA and AFINOS Studies. Int J Behav Med* 2013;20:529–37.

8 Karsten L. It all used to be better? Different generations on continuity and change in urban children's daily use of space. *Child Geogr* 2005;3:275–90.

9 Henne HM, Tandon PS, Frank LD, Saelens BE. Parental factors in children's active transport to school. *Public Health* 2014;128:643–6.

10 Hume C, Timperio A, Salmon J, et al. Walking and cycling to school. Predictors of increases among children and adolescents. *Am J Prev Med*. 2009;36:195–200.

11 Lee C, Zhu X, Yoon J, Varni JW. Beyond distance: children's school travel mode choice. *Ann Behav Med* United States; 2013 Feb;45 Suppl 1:S55–67.

12 Carver A, Salmon J, Campbell K, et al. How do perceptions of local neighborhood relate to adolescents' walking and cycling?. *Am J Heal Promot* 2005;20:139–47.

13 Lu W, McKyer E, Lee C, et al. Perceived barriers to children's active commuting to school: a systematic review of empirical, methodological and theoretical evidence. *Int J Behav Nutr Phys Act* 2014;11:140.

14 Timperio AA, Crawford D, Telford A, Salmon J. Perceptions about the local neighborhood and walking and cycling among children. *Prev Med (Baltim)* 2004;38:39–47.

15 Herrador-Colmenero M, Perez-Garcia M, Ruiz JR, Chillon P. Assessing modes and frequency of commuting to school in youngsters: a systematic review. *Pediatr Exerc Sci*; 2014;26:291–341.

16 Chaufan C, Yeh J, Fox P. The Safe Routes to School Program in California: An Update. *Am J Public Health* 2012;102:e8–11.

17 Oluyomi AO, Lee C, Nehme E, et al. Parental safety concerns and active school commute: correlates across multiple domains in the home-to-school journey. *Int J Behav Nutr Phys Act* 2014;11:32.

18 Cho C-M, Choi Y-S. *The Effect of Resident-Perceived Neighborhood Boundary on the Equity of Public Parks Distribution: Using GIS BT - Web and Wireless Geographical Information Systems: 5th International Workshop, W2GIS 2005, Lausanne, Switzerland, December 15-16, 2005*. Proc. In: Li K-J, Vangenot C, editors. Berlin, Heidelberg, Heidelberg: Springer; 2005. p. 296–307.

19 Dessing D, de Vries SI, Hegeman G, et al. Children's route choice during active transportation to school: difference between shortest and actual route. *Int J Behav Nutr Phys Act* 2016;13:48.

20 Mueller N, Rojas-Rueda D, Cole-Hunter T, et al. Health impact assessment of active transportation: A systematic review. *Prev Med (Baltim)* Elsevier Inc.; 2015;76:103–14. Available from: http://dx.doi.org/10.1016/j.ypmed.2015.04.010

21 Timperio A, Ball K, Salmon J, et al. Personal, family, social, and environmental correlates of active commuting to school. *Am J Prev Med* 2006;30:45–51.

22 Audrey S, Batista-Ferrer H. Healthy urban environments for children and young people: a systematic review of intervention studies. *Health Place* Elsevier; 2015;36:97–117.

23 Carver A, Timperio A, Crawford D. Playing it safe: The influence of neighbourhood safety on children's physical activity—A review. *Health Place* 2008;14:217–27.

24 Muthuri SK, Wachira L-JM, Onywera VO, et al. Associations between parental perceptions of the neighbourhood environment and childhood physical activity: Results from ISCOLE-Kenya. *J Phys Act Heal* 2015.

25 McDonald NC. Critical factors for active transportation to school among low-income and minority students. *Evidence from the 2001 National Household Travel Survey. Am J Prev Med* 2008;34:341–4.

26 Mandic S, Barra SLDL, Bengoechea EG, et al. Personal, social and environmental correlates of active transport to school among adolescents in Otago, New Zealand. *J Sci Med Sport* 2015;18:432–7.

27 Villa-González E, Rodríguez-López C, Huertas Delgado FJ, et al. Factores personales y ambientales asociados con el desplazamiento activo al colegio de los escolares españoles. *Rev Psicol del Deport* 2012;21:343–9.

28 Chillón P, Hales D, Vaughn A, et al. A cross-sectional study of demographic, environmental and parental barriers to active school travel among children in the United States. *Int J Behav Nutr Phys Act* 2014;11:61.

29 Molina-Garcia J, Queralt A, Estevan I, et al. Perceived barriers to active commuting to school: reliability and validity of a scale. *Gac Sanit*; 2012; In press:1–9.

30 Forman H, Kerr J, Norman GJ, et al. Reliability and validity of destination-specific barriers to walking and cycling for youth. *Prev Med (Baltim)* 2008;46:311–6.

31 De Meester F, Van Dyck D, De Bourdeaudhuij I, Cardon G. Parental perceived neighborhood attributes: associations with active transport and physical activity among 10-12 year old children and the mediating role of independent mobility. *BMC Public Health* 2014;14:631.

32 Foster S, Villanueva K, Wood L, et al. The impact of parents' fear of strangers and perceptions of informal social control on children's independent mobility. *Heal Place* 2014;26:60–8.

33 Larouche R, Barnes J, Tremblay MS. Too far to walk or bike?? *Can J Public Heal* 2013;104:487–9.

34 Sirard JR, McDonald K, Mustain P, et al. Effect of a school choice policy change on active commuting to elementary school. *Am J Health Promot*; 2015;30:28–35.

35 Loucaides CA, Jago R, Theophanous M. Prevalence and correlates of active traveling to school among adolescents in Cyprus. *Cent Eur J Public Heal* 2010;18:151–6.

36 Voorhees CC, Ashwood JS, Evenson KR, et al. Neighborhood design and perceptions: relationship with active commuting. *Med Sci Sport Exerc* 2011;42:1253–60.

37 Mendoza JA, Levinger DD, Johnston BD. Pilot evaluation of a walking school bus program in a low-income, urban community. *BMC Public Health* 2009;9:122.

38 Ahern S. Individual and structural influences on parent's transport choices for the school run: a qualitative interview study. UK Society for Behavioural Medicine 11th Annual Scientific Meeting Biology, Behaviour & Environment. Newcastle, 2015.

39 Karanasiou A, Viana M, Querol X, et al. Assessment of personal exposure to particulate air pollution during commuting in European cities-Recommendations and policy implications. *Sci Total Environ. Elsevier B.V* 2014;490:785–97.

40 McDonald NC, Dwelley AE, Combs TS, et al. Reliability and validity of the Safe Routes to school parent and student surveys. *Int J Behav Nutr Phys Act* 2011;8:56.

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Education predicts cervical cancer survival: a Lithuanian cohort study

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Background*:* We examined inequalities in cervical cancer survival in Lithuania by education and place of residence. **Methods**: The study is based on the linked dataset that includes all records of the 2001 population Census, all records from Lithuanian Cancer Registry (cancer incidence) and all death and emigration records from Statistics Lithuania for the period between 6 April 2001 and 31 December 2009. The study group includes cervical cancers registered in the Cancer Registry from 1 January 2002 to 31 December 2006. Analysis was restricted to women who were 25–64 years old at the Census date (in total 1 866 cases). **Results**: During the study period there were 671 deaths corresponding to an overall 5-year survival proportion 64.13% (95% CI 61.86–66.31). Place of residence and education of cervical cancer patients had strong impact on survival; 5-year survival was higher in women living in urban areas than in rural (68.61 and 55.93%) and survival decreased with decreasing education: from 79.77% in highest education group to 64.85 and 50.48% in groups with secondary and lower than secondary education. The effect of place of residence declined when stage of disease was included in the model and became not significant in final model with education adjustment. The effect of education declined after inclusion of stage and other variables, however, remained significant. **Conclusions**: We found that women with higher education experienced higher survival following a cervical cancer diagnosis, and stage of disease at the time of diagnosis explains only the part of observed differences.

Introduction

Several decades of research have documented social disparities in cancer incidence, mortality and survival.[1,2] These inequalities are evident in many European countries and for almost all cancer sites.[3–10] These studies raised questions about causes underlying the generally higher cancer incidence and lower cancer survival in lower socio-economic groups. A common hypothesis is that a higher exposure to important risk factors explains the higher incidence of specific cancer types in low social groups. Distribution of cervical cancer risk factors may differ in different socio-economic groups of women. It is well-established that human papillomavirus infections play a critical role in the development of cervical cancer. However, other risk factors interact with it to define individual risk.[11,12] Many reproductive, lifestyle and behavioural factors associated with education may affect cervical cancer risk including human papillomavirus infection, parity, smoking, nutrition, oral contraceptive and participation in health promotion or cancer screening programs.

Regarding cancer survival, studies have consistently observed that the stage at diagnosis only partly explained the poorer survival found among more deprived social groups.[2] Early stage at diagnosis is the most important prognostic factor for survival, and it has been widely recognized as differently distributed across socio-economic classes. However, it is becoming increasingly apparent that this association is more complex than some studies indicate. Disparities in survival are probably due to multiple factors, including differences in stage distribution, differences in levels of comorbidity and differential access to health care between educational groups.

We have previously described inequalities in cancer mortality and incidence by education level in Lithuania.[13,14] Higher cancer mortality was reported for rural population.[15] Cervical cancer incidence and