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Original Research Article

Associations between built environment and physical activity of 7–8-year-old children. Cross-sectional results from the Lithuanian COSI study

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ABSTRACT

Background and aim: Research shows that regular engagement in physical activity in childhood is associated with multiple physical and psychosocial health benefits. The data on associations between children physical activity level and built environment in Lithuania are limited. The built environment is one of many variables thought to affect children physical activity level. But consequently there is growing interest in how physical environment influences physical activity of school age children. The aim of this paper is to evaluate associations between physical activity of primary school age children and built environment (road safety, travel distance, playgrounds, etc.) in Lithuania.

Materials and methods: Data were obtained participating in the WHO European Childhood Obesity Surveillance Initiative (COSI). The study protocol was granted ethical approval from Lithuanian Bioethics Committee (No. 6B-10-02). Parents/guardians provided written informed consent. A cross-sectional study was carried out in 2013. A multilevel sampling method was employed for composing a national representative sample. The representing data were collected by means of standardized questionnaires, which were filled out by 3802 parents of the selected first-formers.

Results: The mean age of the first-formers was 7.3 years (SD 0.5). More than half (62.2%) of parents stated that roads to schools were safe; most (78.7%) of adults notified that children had where to play and exercise in their living area. Place of residence of family and recreation areas in living environment were significant predictors of children's daily physical activity and possibility to attend sport or dancing clubs.

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Conclusions: Results from the national survey of 7–8-year-old children of Lithuania reveal that urban living area of families, availability of playgrounds and recreational facilities were associated with higher possibilities of children to be sufficiently physically active.

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1. Introduction

Whether children are biking to school, taking the stairs or walking the dog – being physically active offers countless benefits [1,2]. Research shows that regular engagement in physical activity in childhood is associated with multiple physical and psychosocial health benefits [3–6]. The built environment is one of many variables thought to affect physical activity level of children. The availability of sidewalks, playgrounds, parks and other recreation areas are associated with positive changes in daily physical activity level and overall health of children [7,8].

But some components of environment such as travel distance, road safety, heavy traffic and crimes are associated with inactive commuting and total reduction of physical activity [9,10]. Parental concern due to unsafe children environment leads to higher transportation, inactivity level and limit the ability of independent mobility in local neighborhood and outdoor play [11,12]. Also parents' concern might get greater as younger children stay outside without adult's supervision. Parental anxiety about road safety is justified as most deaths among 1- to 14-year-old children are caused by road traffic injuries in developed countries [13]. For these reasons children now spend less time playing outdoors and more time engaged in indoor sedentary leisure pursuits at home [14,15]. According to the data of the Lithuanian Road Administration under the Ministry of Transport and Communications of the Republic, the number of accidents, injured and killed persons was decreasing during 2000–2013 [16], but children in Lithuania have a 7-fold higher probability of being killed in traffic accidents if compared to Sweden which is the best performing in road safety [17].

In Lithuania the data on children physical activity and associations with built environment are limited. But consequently there is growing interest in how physical environment influences physical activity of school age children. Therefore, the aim of this study was to evaluate associations among physical activity of primary school age children and road safety, travel distance, availability of playgrounds and other components of living environment.

2. Materials and methods

Data were obtained participating in the World Health Organization (WHO) European Childhood Obesity Surveillance Initiative (COSI), which was performed in all 10 districts of Lithuania. The third round of the study was carried out in 2013.

A cross-sectional survey was performed using the protocol and methodology prepared by the experts from the WHO and countries participating in the Initiative. The study protocol was granted ethical approval from the Lithuanian Bioethics Committee (No. 6B-10-02). Parents/guardians provided written informed consent. A multilevel sampling method (district, school, and class) was employed for composing a national representative sample. The data were collected by means of standardized questionnaires, which were filled out by 3802 parents of the selected first-formers. In this paper a part of questions regarding children's physical activity and build environment characteristics is analyzed. Time spent in physically active way from moderate to vigorous intensity by children was calculated as the sum of hours per day from the following questions: “How many hours per day does your child play outside, at home or somewhere else on weekdays and weekends?”; “Over a typical week, on how many days does your child go to sport or dancing club(s)?”; “For how much time each week does your school provide physical education lessons (counted in minutes)?” This calculation is based on the suggestion that 60 and more min of physical activity can be accumulated throughout the day in school, during physical education and recess, during intramural sports, in before-school and after school programs [18–20]. In accordance with sanitary norm HN 20:2012 of the Ministry of Health of the Republic of Lithuania, it was assumed that duration of one day single sport or dance occupation of first-former is equivalent to 45 min of intensive physical activity.

The build environment is defined as human-made surrounding that provide the settings for activity, ranging in scale from buildings and parks or green space to neighborhoods and cities that can often include their supporting infrastructure [21]. In this paper build environment variables such as distance, roads safety to/from school, playgrounds, recreation areas and urbanization level are analyzed.

2.1. Statistical analysis

Statistical analysis was performed by using SPSS 20.0 software for Windows. Descriptive data of main characteristics of children and parents were reported as percentages, means and SD. The chi-square and Z tests with Bonferroni correction were used to compare children's physical activity according to their age and gender and association with physical activity of families. Binary logistic regression (odds ratios [OR] with 95% confidence interval [CI]) analysis was used to predict daily physical activity of children or attendance of sport/dance club depending to build environment. For all tests $P < 0.05$ was considered significant.

2.2. Variables

2.2.1. Dependent variables

Daily physical activity of children and attendance of sport or dancing clubs were analyzed. Parents were asked to indicate the frequency of daily physical activity of their children counted in hours per day and the attendance of sport or dancing clubs by ticking one of the offered responses. Response options about physical activity of children were recoded from four possible options into dichotomous outcome variables (1 = 1 h or more; 0 = less than 1 h). The attendance of sport or dancing clubs was coded into dichotomous variables (1 = attend; 0 = do not attend).

2.2.2. Independent variables

Six built environment variables (family place of residence, housing, road safety to/from school, playgrounds/recreation areas and children transportation to and from school) were used in the analysis. Family place of residences from three possible response options was recoded into two categories (urban: big cities and towns; rural: small towns and villages). Transportation form of children to/from school from five response options was recoded into two categories (active transportation to school: walking or cycling; non-active transportation to school: traveling by school, public bus or family car). Physical activity level of family was attributed as independent variable while performing logistic regression analysis.

3. Results

The complete data were available for 3802 parents and their children. **Table 1** presents the general characteristics of children and their families. The mean age of the children was 7.3 years (SD 0.5). Distribution of children by gender was equal. The calculated mean age of mothers and fathers was 35.08 years (SD 5.5) and 37.78 years (SD 6.1), respectively. More than half (61.7%) of the families considered themselves as physically active. Significant differences were found between children and families' physical activity level. Children who lived in families where both parents considered themselves as

Table 1 – Participant's characteristics.

Variable	Total participants (n = 3802)
Child age (years), mean (SD)	7.3 (0.5)
Child sex (male), n (%)	1920 (49.8)
PA of children	
Children who attend sport or dancing clubs, n (%)	1909 (51.1)
Time spent by children in physically active way from moderate-to-vigorous intensity (in hours/day), n (%)	
Less than 1 h a day	202 (6.5)
1–2 h a day	1024 (33)
More than 2 hours a day	1879 (60.5)
Children who are actively commuting to school, n (%)	1721 (45.5)
Children who are actively commuting from school n (%)	2181 (58.7)
Parental age, years, mean (SD)	
Maternal age	35.08 (5.5)
Paternal age	37.78 (6.1)
Parental subjectively assumed family PA level, n (%)	
Physically active	2311 (61.7)
Physically inactive	1435 (38.3)
Parent's perception of road safety to school, n (%)	
Safe	2290 (62.2)
Unsafe	1392 (37.8)
Parental perception of children's recreation areas in their living environment, n (%)	
Have	2930 (78.8)
Do not have	786 (21.2)
Family housing conditions, n (%)	
Private house	1572 (42.9)
Flat	2094 (57.1)
Family's place of residence, n (%)	
Urban	2943 (77)
Rural	877 (23)

physically inactive were 3.5 times more physically inactive compared with children where both parents mentioned they were physically active (**Figure**). The majority (77%) of families lived in urban area (mostly cities). Half of the parents (51.1%) stated that their children attend sport or dance clubs. Almost two-thirds (60.5%) of 7–8-year-old children spent more than 2 h a day in a physically active way. Parents reported that children

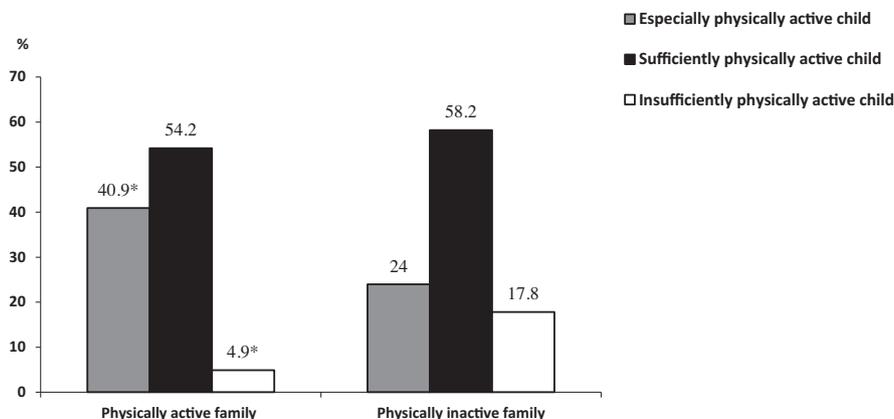


Figure – Association of children and family physical activity. *P < 0.001, compared with physically inactive families (Z-test by Bonferroni correction).

Table 2 – Independent predictors of children daily physical activity and attendants to sport clubs from binary logistic regression analysis.

Dependent/independent variables	Daily physical activity of children (1 h and more)		Attendance to sport or dancing clubs	
	OR (95% CI)	P	OR (95% CI)	P
Family place of residence				
Urban	1.43 (1.19–1.72)	0.001	1.78 (1.48–2.150)	0.001
Rural	1		1	
Family's housing				
Private house	0.989 (0.868–1.127)	0.867	0.855 (0.72–1.02)	0.08
Flat	1		1	
Road safety to school				
Safe	1	0.147	0.89 (0.76–1.1)	0.16
Unsafe	0.893 (0.767–1.041)		1	
Children's playground and recreation area				
Have	1.32 (1.1–1.58)	0.003	1.4 (1.16–1.68)	0.001
Do not have	1		1	
Children commuting to school				
Active (walking or cycling)	0.9 (0.72–1.13)	0.375	0.85 (0.67–1.06)	0.15
Non active (traveling by school, public bus or family car)	1		1	
Children commuting from school				
Active (walking or cycling)	1.1 (0.86–1.37)	0.48	0.97 (0.77–1.23)	0.81
Non-active (traveling by school, public bus or family car)	1		1	

P < 0.001. Model adjusted by gender.

walked or biked from school more frequently than to school (58.7% and 45.5%, respectively). While analyzing the way first-formers commuting to/from school and children age, gender or parental age no significant differences were found. More than half (62.2%) of the parents stated that roads to school were safe and most (78.7%) of the adults reported that children had where to play and exercise in their living area.

The results of binary regression analysis after adjustment by gender are presented in Table 2. Family place of residence, recreation areas in their living environment were significant predictors of children's daily physical activity and possibility to attend sport or dancing clubs. The strongest predictors of daily physical activity of children for 1 h and more were: family place of residence (OR = 1.43) and availability of recreation areas (OR = 1.32), while family housing, road safety to/from school and children commuting to/from school were not significant contributors. The strongest predictors of children attendance of sport or dancing clubs were the same variables: family place of residence (OR = 1.78) and the recreation areas (OR = 1.4).

4. Discussion

The aim of the current study was to examine associations between physical activity of 7–8-year-old children and built environment such as road safety, distance to/from school, availability of playgrounds, etc. Study results showed that children living in urban areas tended to have higher possibility to attend sport or dance clubs and accumulated recommended 1 h and more of daily physical activity. This can be explained by the fact that abilities to enjoy playgrounds, opportunities for organized and planned physical activity forms are greater in big or bigger cities in Lithuania as bigger local municipalities are able to invest more than small ones. These findings are

consistent with the results of the international study performed by Ding et al. [22] from 11 countries where it was determined that higher residential density was associated with higher odds of meeting adults' physical activity recommendations. Similar findings were determined in Greek primary school children study where it was found that urban children spent more time in sports activities while rural children were more physically active after school [23]. Other investigators present the opposite results stating that no associations between children physical activity and family place of residence were established, explaining that the line between urban and rural living area's in majority of countries is blurring [24,25]. Therefore our study findings indicate that children living in rural residency need to be targeted for priority physical activity intervention programs at schools.

Housing is a fundamental determinant of health and improvement in quality of general, respiratory and mental health [26,27]. In our survey no significant differences in physical activity level of children living in private house or flat were found. This finding suggests that regardless of housing conditions possibilities of children to be physically active were similar. Contrary the qualitative study done in Australia (2014) presented that overall size, space and design of family housing can influence physical activity of children at home [28].

Scientific research indicates that neighborhood social cohesion and road safety were associated with increases in the number of walking and cycling trips to school [29]. Logistic analysis performed in our study pointed out that parent's perception of road safety to school was not a significant contributor of daily physical activity or attendance of sport or dancing clubs. Different results were obtained in several studies in which the relationship between road safety and children physical activities were confirmed [30–32]. Scientific studies also identified that parental perceptions of unsafe road environment was associated with children's independent

mobility [33] and parental restriction of child's active commuting from school [34].

Another important component of built environment is recreation areas and playgrounds. Parks and other recreation areas provide places for people to experience nature, engage in physical activity, and relax [35]. Study results showed significant associations between availability of local playgrounds, recreation areas and children daily physical activity as well as the attendance of sport or dancing clubs. These findings are consistent with the results of Sallis et al. [36] who performed systemic review analysis and found that in many countries availability of and proximity to recreation facilities have been associated consistently with greater physical activity among children [8,36] and adolescents [37,38]. The study by Ding et al. [22] with the adult population, where Lithuania also participated, revealed that the presence of free or low-cost recreation facilities (e.g., parks, public swimming pools) in the neighborhood was significantly associated with higher odds of meeting physical activity recommendations.

Walking or cycling to/from school, known as active school transportation behavior, has been identified as a potential opportunity for the accumulation of moderate to vigorous physical activity among children and youth [39,40]. Our logistic regression analysis established that the way children commuted to/from school was not a significant factor for school-children's daily physical activity or attendance to sport or dancing clubs. Study results can be based on the fact that active play outdoor at current age gives the greatest opportunity to reach recommended level of physical activity. These findings were contrary to those found in similar studies. In a study of Cooper et al., cycling to school was associated with higher overall physical activity level only in boys [41]. Sirard et al. (USA) determined that regular active commuting of fifth grade children from elementary school prolonged moderate vigorous physical activity level per day approximately 24 min [40].

4.1. Strengths and limitations

The strengths of the present study were: this was the first study to assess physical activity of the national sample of 7–8-year-old children in all counties of the country. Also six aspects of built environment (family place of residence, housing, and road safety to school, commuting to and from school, availability of children playground and recreational areas) were analyzed. The present study had some limitations. Firstly, this study had a cross-sectional design, which did not allow drawing conclusions about causal relationships. Secondly, assessment of attendance of sport/dance clubs by children was based on parents' self-reports which cannot exclude misreporting and recall biases.

5. Conclusions

The results from the national survey of 7–8-year-old children of Lithuania revealed that urban living area of families, availability of playgrounds and recreational facilities were associated with higher possibilities of children to be sufficiently physically

active. Further research is needed to explore this possible association as understanding and modifying the built environments where children live, attend school, and play may be a promising strategy to increase their physical activity level.

Conflict of interests

The authors declare that they have no conflict interests.

Authors' contributions

A.P. is the coordinator and principal investigator of COSI study in Lithuania. V.Ž. conducted the analyses, interpreted the data and drafted the manuscript. A.P. advised on data analysis and interpretation of results. The authors critically revised the manuscript and approved of it in its final form.

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