ACTIVE SCHOOL TRANSPORT AMONG CZECH ADOLESCENTS DECLINED BETWEEN 2006 AND 2022: HBSC STUDY FINDINGS

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SUMMARY

Objectives: Active school transport (AST), such as walking or cycling to and from school, represents an important source of daily physical activity for adolescents. In recent decades, however, many high-income countries have reported a steady decline in AST. The main objective of this study was to describe long-term trends in active travel to and from school among Czech adolescents aged 11, 13 and 15 years, using nationally representative data collected in five waves of the Health Behaviour in School-aged Children (HBSC) study between 2006 and 2022.

Methods: The analysis is based on a total sample of 50,813 adolescents (25,628 boys, 25,085 girls) aged 10.5–16.5 years, with valid self-reported data on travel modes to and from school. AST was defined as walking or cycling as the primary mode of transport. The prevalence of AST was analysed over time by gender and age category. Binary logistic regression was used to assess the associations between AST and survey year, gender, age group, socioeconomic status (Family Affluence Scale), and commuting time to school.

Results: Between 2006 and 2022, the prevalence of AST to school declined from 71.6% to 54.9% among boys and from 71.8% to 54.8% among girls. A similar trend was observed for AST from school, although participation remained consistently higher than in the morning. The strongest negative predictors of AST were longer commuting time and higher socioeconomic status. Girls had slightly lower odds of AST than boys, and older adolescents (only in fully adjusted models) were more likely to engage in AST.

Conclusions: The long-term decline in AST among Czech adolescents highlights the need for targeted public health and urban planning strategies. In particular, the lower rates of AST to school suggest potential opportunities for morning-focused interventions.

Key words: school travel, walking, cycling, adolescent behaviour, socioeconomic factors, time factors

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INTRODUCTION

Active school transport (AST), primarily walking and cycling, plays a key role in increasing physical activity among adolescents (1), contributing to better cardiovascular fitness (2), lower obesity risk (3), fewer psychosomatic symptoms, and improved mental wellbeing (4). Beyond individual health benefits, AST also supports environmental sustainability by reducing traffic congestion, air pollution, and greenhouse gas emissions in urban areas (5). Despite these advantages, participation in AST has been steadily declining in many high-income countries (6), including the Czech Republic (7, 8).

Several factors can influence AST participation, including school distance (9), socioeconomic status (SES) (10) or gender and age (11). Adolescents who travel longer distances to school are generally less likely to use AST (12). Previous research has shown mixed findings regarding the relationship between SES and AST participation (13). While some studies suggest that adolescents from lower-income families are more likely to engage in AST (14), others report no clear association or even higher AST rates among those from higher socioeconomic backgrounds, depending on local contextual factors such as traffic intensity (6), neighbourhood safety (7) and infrastructure (15). Additionally, age differences play a role, as older adolescents may have more independence in choosing their mode of transport (16).

While prior studies documented AST declines between 2006 and 2014 (7), evidence on more recent trends remains limited. Whether this decline has stabilized, continued, or shifted across different demographic groups is unclear, highlighting the need for updated data. And precisely for this reason, this study analyses long-term trends (2006–2022) in AST among Czech adolescents using Health Behaviour in School-aged Children (HBSC) data and examines key factors influencing AST participation, specifically school distance, age and SES.

MATERIALS AND METHODS

Study and Participants

This study analyses data from five waves of the Czech HBSC survey conducted in 2006, 2010, 2014, 2018, and 2022, focusing on AST among adolescents aged 11, 13 and 15 years. The HBSC

study is an international, repeated cross-sectional survey that monitors adolescent health and wellbeing across Europe, Canada and Central Asia in collaboration with the World Health Organization. Data are collected every four years using a standardized methodological protocol to ensure comparability across countries and time periods (17).

The study employs a stratified random cluster sampling design, with schools serving as the primary sampling units. The survey is conducted in classrooms under the supervision of trained researchers, and participants provide anonymous, self-reported data through a standardized questionnaire. Parents/guardians are informed about the study via school administrators and have the option to withdraw their child from participation. Before completing the questionnaire, all participants confirm their informed consent and are informed that they have the right to refuse participation or withdraw at any time.

Ethical approval for the study was granted by the Institutional Ethics Committee for Research of the Faculty of Physical Culture, Palacký University Olomouc (reg. no. 14/2019).

The final dataset consists of 50,813 adolescents (50.1% boys) (2006: boys n = 2,310, girls n = 2,299; 2010: boys n = 2,143, girls n = 2,276; 2014: boys n = 6,986, girls n = 7,115; 2018: boys n = 6,789, girls n = 6,577; 2022: boys n = 7,296, girls n = 7,022) aged 10.5–16.5 years with valid and complete data on AST variables.

Measures

Active transport was assessed by asking the question how adolescents completed the main part of the journey to/from school with possible answers: walking, cycling, bus, train, tram or other means of public transport, car, motorcycle, other means. Walking or cycling were considered as modes of active transport.

The control variables were gender (boys/girls), age category (11-, 13- and 15-year-old adolescents), family affluence and time travel to school. The Family Affluence Scale (FAS) included items "Do you have your own bedroom for yourself?" (no = 0, yes = 1); "Does your family own a car, van or truck?" (no = 0, one = 1, two or more = 3); "How many bathrooms are in your home?" (none = 0, one = 1, two = 2, three or more = 3); "How many times did you and your family travel out of your country for a holiday last year?" (never = 0, once = 1, twice = 2, three or more times = 3); "Does your family have a dishwasher at home?" (no = 0, yes = 1) and "How many computers does your family own?" (none = 0, one = 1, two = 2, three or more = 3). Summary score was created by summing all the FAS-related responses together. This FAS summary score was converted into fractional rank scores and used to determine the SES of the families of the adolescents in the lowest 20% (low), middle 60% (medium), and highest 20% (high) category (18, 19). Time travel to school was assessed using the question: "How long does it usually take you to travel from home to school?" (less than 5 min, 5–15 min, 15–30 min, 30 min to an hour, more than an hour).

Statistical Analysis

Statistical processing was conducted in the Statistical Package for the Social Sciences IBM SPSS v.26 software (Armonk, NY, USA). For the basic description of the variables, the weighted percentages and counts of the selected variables are presented. The post-stratification weights were applied to reflect the actual distribution of the target population across 14 Czech administrative regions.

Logistic regressions (enter method) were used to examine the odds of active travel to school or from school. The tested models included the following independent categorical variables: year of HBSC survey (2022, 2018, 2014, 2010, 2006), gender (boys vs. girls), children's age category (11y, 13y, 15y), FAS (low, middle, high), and time travel to school (< 15 minutes, 15–30 minutes, ≥ 30 minutes). Statistical significance was set at alpha level 0.05. In addition, crude (unadjusted) logistic regression models including age category only were computed for both outcomes to quantify unadjusted age differences and to facilitate interpretation of differences between descriptive prevalence estimates and fully adjusted models.

RESULTS

Trends in Active School Transport (2006–2022)

The proportion of adolescents using AST to school steadily declined between 2006 and 2022, with notable gender differences. In 2006, AST participation was nearly identical for boys (71.6%) and girls (71.8%). The largest decrease occurred between 2006 and 2010, with girls experiencing a sharper decline (−14.5 percentage points) compared to boys (−11.3 percentage points). After 2010, the decline slowed, and AST rates stabilized, particularly between 2014 and 2018, when participation remained almost unchanged. By 2022, AST participation dropped to 54.9% for boys and to 54.8% for girls, suggesting a convergence towards consistently lower AST levels (Fig. 1).

A similar declining pattern was observed for active transport from school, even though participation remained slightly higher than for travel to school. In 2006, boys (74.4%) and girls (74.0%) had comparable AST rates. The sharpest decline occurred also between 2006 and 2010 (boys: −10.6 percentage points, girls: −11.8 percentage points). Unlike morning travel, AST rates fluctuated more in later years, with a temporary increase among girls between 2014 and 2018, while boys showed a slight continued decline. By 2022, AST participation had dropped to 62.0% for both boys and girls. Across all survey years, rates of active transport were consistently higher after school than in the morning. This pattern was observed across genders and age groups (Fig. 1).

Detailed data on the prevalence of AST to and from school by the year of data collection, age, and gender are presented in the following Table 1.

Factors Influencing Active School Transport

Logistic regression analysis confirmed a significant decline in AST over time. Adolescents in 2006 had significantly higher odds of AST compared to 2022 (OR = 1.85 for travel to school, OR = 1.49 for travel from school, $p < 0.001$). Girls had slightly lower odds of AST than boys (OR = 0.91 and 0.93, $p < 0.001$), and 15-year-olds had higher odds than 11-year-olds (OR = 1.23 for travel to school, OR = 1.12 for travel from school, $p < 0.001$). However, crude (age-only) models indicated lower odds of AST

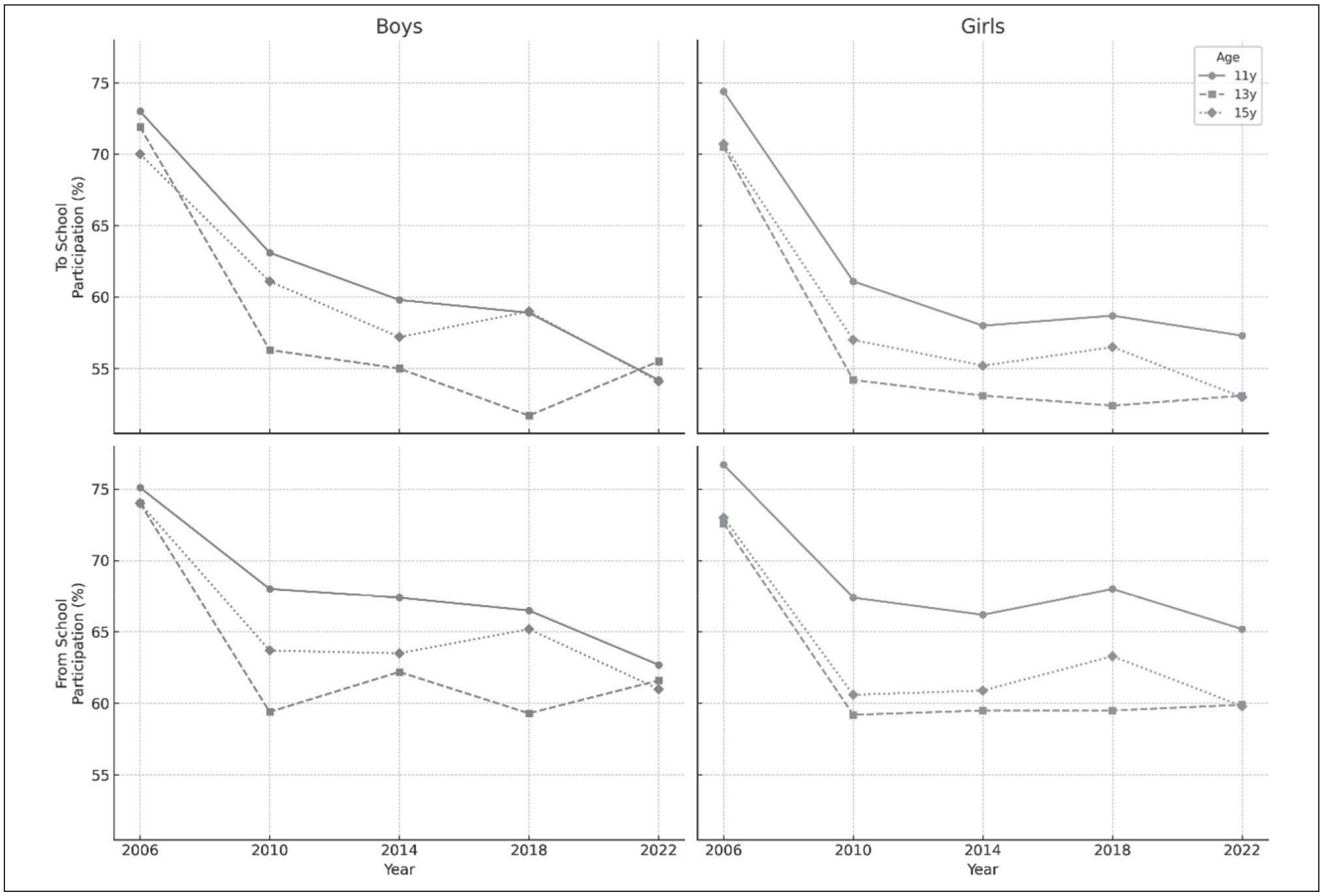

Fig. 1. *Trends in active school transport to and from school among Czech adolescents aged 11, 13 and 15 years by gender (2006–2022).*

Table 1. *Active travel to and from school: trends by year, age and gender*

		Proportion of adolescents with active travel to school Survey year				
Gender	**Age (years)**	**2006 (%)**	**2010 (%)**	**2014 (%)**	**2018 (%)**	**2022 (%)**
Boys	11	73.0	63.1	59.8	58.9	54.2
	13	71.9	56.3	55.0	51.7	55.5
	15	70.0	61.1	57.2	59.0	54.1
Girls	11	74.4	61.1	58.0	58.7	57.3
	13	70.5	54.2	53.1	52.4	53.1
	15	70.7	57.0	55.2	56.5	53.0
		Proportion of adolescents with active travel from school Survey year				
Gender	**Age (years)**	**2006 (%)**	**2010 (%)**	**2014 (%)**	**2018 (%)**	**2022 (%)**
Boys	11	75.1	68.0	67.4	66.5	62.7
	13	74.0	59.4	62.2	59.3	61.6
	15	74.0	63.7	63.5	65.2	61.0
Girls	11	76.7	67.4	66.2	68.0	65.2
	13	72.6	59.2	59.5	59.5	59.9
	15	73.0	60.6	60.9	63.3	59.8

among older adolescents compared with 11-year-olds. For travel to school, the odds were lower in 13-year-olds (OR = 0.838, 95% CI: 0.803–0.874, $p < 0.001$) and 15-year-olds (OR = 0.905, 95% CI: 0.867–0.945, $p < 0.001$). For travel from school, the odds were similarly lower in 13-year-olds (OR = 0.783, 95% CI: 0.749–0.818, $p < 0.001$) and 15-year-olds (OR = 0.837, 95% CI:

Table 2. *Logistic regression analysis to have active transport to and from school*

	Active travel to school			Active travel from school		
	n	OR	95% CI	n	OR	95% CI
Survey year						
2022	13,857	Ref.		13,868	Ref.	
2018	13,005	1.02	0.97–1.08	12,998	1.04	0.99–1.10
2014	13,667	1.12***	1.06–1.18	13,581	1.10**	1.04–1.16
2010	4,253	1.07	0.99–1.16	4,220	0.93	0.86–1.01
2006	4,498	1.85***	1.71–2.01	4,471	1.49***	1.37–1.62
Gender						
Boys	24,628	Ref.		24,537	Ref.	
Girls	24,652	0.91***	0.88–0.95	24,601	0.93***	0.89–0.96
Age category/grade						
11y/5th	15,334	Ref.		15,263	Ref.	
13y/7th	16,674	1.04	0.99–1.09	16,638	0.96	0.91–1.01
15y/9th	17,272	1.23***	1.17–1.30	17,237	1.12***	1.07–1.18
Family Affluence Scale						
Low	8,139	Ref.		8,102	Ref.	
Middle	31,939	0.64***	0.61–0.68	31,875	0.69***	0.65–0.73
High	9,202	0.41***	0.38–0.44	9,161	0.50***	0.47–0.54
Time travel to school						
< 15 minutes	32,392	Ref.		32,287	Ref.	
15–30 minutes	11,924	0.18***	0.17–0.19	11,898	0.21***	0.20–0.22
≥ 30 minutes	4,963	0.07***	0.06–0.08	4,953	0.09***	0.08–0.10

Logistic regression (enter method)

OR – odds ratio; 95% CI – 95% confidence interval; Ref. – reference category; ***p < 0.001; **p < 0.01

0.800–0.875, p < 0.001). Compared with the unadjusted prevalence in Table 1, adjusted estimates (conditional on commuting time and family affluence) yielded different age gradients.

The strongest determinant of AST was travelling distance. Adolescents commuting 15–30 minutes to school were 80% less likely to use AST than those living within 15 minutes (OR = 0.18 for travel to school, OR = 0.21 for travel from school, p < 0.001). For those commuting 30 and more minutes, the odds were reduced by over 90% (OR = 0.07 and 0.09, p < 0.001). Higher SES was also associated with lower odds of AST, with high-income adolescents having 50–59% lower odds than those from low-income backgrounds (OR = 0.41–0.50, p < 0.001). Table 2 provides a detailed summary of logistic regression results.

DISCUSSION

The findings confirm a long-term decline in AST among Czech adolescents, aligning with trends observed in other Czech (7, 8) and European (20) studies. While many high-income countries, including Australia (21), have experienced a steady decline in AST, recent data from low- and middle-income countries suggest that AST rates have remained stable or even increased, likely due to limited access to motorized transport (22). This contrast highlights the role of broader socioeconomic and infrastructural differences in shaping AST trends across regions. These results suggest that the factors influencing AST are highly context-dependent, shaped not only by individual and family characteristics but also by broader social and environmental factors.

Our analysis confirmed that travel distance, SES, age and gender are significant determinants of AST participation. Adolescents commuting more than 15 minutes were over 80% less likely to use AST, while those travelling over 30 minutes had more than a 90% lower likelihood of AST. This strong inverse relationship is consistent with prior research demonstrating that longer commuting distances significantly reduce the likelihood of active school travel (23). The relationship between SES and AST is not consistent across the literature and may vary by context. While some studies report that adolescents from higher-income families are less likely to use active transport (24), others present opposite or inconclusive findings (25). In our sample, AST participation was significantly lower among adolescents from middle- and high-income families compared to those from low-affluence backgrounds, regardless of travel direction. This finding highlights the potential role of economic factors in shaping school commuting behaviour in the Czech setting. In addition, prior research indicates that AST is more common in areas with well-developed pedestrian and cycling infrastructure (26). Notably, age effects differed between crude and adjusted analyses. While crude models and unadjusted prevalence patterns suggested lower AST among older adolescents, the fully adjusted models indicated higher odds of AST for 15-year-olds when commuting time and

family affluence were held constant. This pattern is consistent with confounding/suppression by commuting time and socioeconomic differences across age groups and suggests that, at comparable commuting time, older adolescents may have greater autonomy to choose active modes.

The decline in AST has potential public health and environmental implications. Reduced AST contributes to lower daily physical activity, increasing the risk of obesity, cardiovascular disease, and poor mental wellbeing among adolescents (27). Additionally, greater reliance on motorized transport exacerbates traffic congestion and air pollution, particularly in urban areas (28). Given the observed negative trend and its associated consequences, we believe that urban planning and policy decisions should incorporate elements that support AST like increasing environmental literacy among adolescents (29). This may include the development of safe and accessible infrastructure, as well as the implementation of school- or community-based interventions aimed at promoting active commuting among adolescents. Notably, the consistently lower AST rates in the morning suggest a potential window of opportunity for targeted interventions focused on the journey to school.

Although this study provides valuable insights into long-term trends in AST, it relies on self-reported data, which may introduce recall bias. Additionally, while the analysis identifies associations between demographic factors and AST, the cross-sectional design does not allow for causal inferences. Future research should explore qualitative aspects of AST decline, including factors such as parental attitudes toward active commuting, which were identified as an important determinant of AST participation (30).

CONCLUSIONS

This study provides nationally representative evidence on long-term trends in AST among Czech adolescents and identifies key factors associated with its participation. The findings reveal a steady decline in AST between 2006 and 2022, with consistently higher rates reported for travel from school than to school. SES and commuting distance emerged as strong predictors of AST, with adolescents from higher-income families and those commuting longer distances significantly less likely to engage in active transport. Age patterns differed by analytic approach: unadjusted prevalence and crude models showed lower active school transport among older adolescents, whereas in fully adjusted models (accounting for commuting time, family affluence, gender, and survey year), the association attenuated and reversed for 15-year-olds. These results underscore the need for continued monitoring and suggest that public health and urban planning policies should consider socio-demographic disparities and environmental conditions when designing interventions to promote AST.

Conflicts of Interest

None declared

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