

Active but not Independent: Children's School Travel Patterns in a Compact-City Environment in Greece

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Abstract

Children's active travel and independent mobility, especially regarding their daily travel to and from school, is essential for their wellbeing, influencing their physical health, psychology, social and cognitive skills, as well as priming children and youth for active and sustainable mobility choices when they become adults. Although active travel and independent mobility are interrelated concepts, they are quite distinct from each other, since a child's active travel to school, on foot or by bicycle, can also occur with an adult escort. This article investigates children's school commute patterns in a compact-city environment, using a structured questionnaire addressed to parents of elementary school children. The empirical study was conducted in Kordelio-Evosmos, a densely populated municipality in western Thessaloniki, which has one of the highest percentages of child population among Greek cities. The survey included questions about children's school travel patterns, parents' own perceptions of the characteristics of the school route, and their views regarding the overall quality of the neighbourhood environment. Children's age ranged from 6 to 12 years, with 72.82% being 9 years or over. We found that 66.5% of the children commute to school on foot; however, only 14.08% do so on their own. Parents' decision to escort their children along the route contradicts the area's compact-city attributes, such as short distances between home and school and mixed uses. Problematic aspects of the neighbourhood environment such as unsafe crossings, poor pedestrian infrastructure, and drivers' illegal behaviour were found to influence parents' decisions over their children's travel modes.

Keywords

active school travel; children's independent mobility; compact city; elementary school; Greece; parental attitudes; pedestrian infrastructure; traffic danger; walking with adult escort

1. Introduction

The journey from home to school and back constitutes a meaningful part of children's and young people's everyday life and it is influenced by intrapersonal, interpersonal, and physical environment factors (Wilson et al., 2018). School travel modes include active mobility, such as walking, cycling, and roller-skating, and motorised travel, such as school buses, public transport, and private cars, usually driven by a parent or guardian. As a behavioural choice, the mode of school travel depends on many factors, including the age and gender of the child, the characteristics of their family, the distance between home and school, the physical design of the route, the available means of public transport, the climate and weather conditions, and the dominant culture (Lee et al., 2013). During past decades there has been a reduction of active travel in the Western world and an increase in passive modes of mobility (Shaw et al., 2015), leading to the rise of the so-called "back-seat generation" (Karsten & Van Vliet, 2006) with negative consequences on the physical and mental health of children (Rothman et al., 2018) and on street traffic in cities (McMillan, 2007). Active school travel (AST) as a habit of children promotes physical activity and good health (Larouche et al., 2014), while decreasing car dependency (Mammen et al., 2015).

Studies on AST are part of research on children's independent mobility (CIM), a term referring to children's freedom to get around in their neighbourhood unaccompanied by adults (Hillman et al., 1990). Independent mobility is a fundamental right of children, recognised in the UN Convention on the Rights of the Child (1989), which states that children should be able to live in an environment that meets their physical, social, and mental needs (Convention on the Rights of the Child, 1989, Article 27). CIM as a research subject is addressed in studies in various disciplinary fields, from children's geographies (Schoeppe et al., 2016) to transport studies (Mehdizadeh et al., 2016), paediatrics (Mah et al., 2017), and public health (Ramanathan et al., 2014).

Although AST and CIM are interrelated concepts, they are quite distinct from each other, since a child's active travel to school, on foot or by bicycle, can also occur with an adult escort (Mammen et al., 2012). The decision to accompany the child has been found to be primarily influenced by parental concerns about traffic, the child's personal safety, and the child's maturity and cognitive ability regarding navigating their way to/from school safely (Faulkner et al., 2010). Accompanied by an adult or not, the child who travels actively to school enjoys the same benefits of exercise (Faulkner et al., 2009). When escorted, children experience positive emotions, as being accompanied along the way to school gives them the opportunity to interact with the parent (O'Brien, 2001). On the other hand, when a child travels to school accompanied by an adult, they miss opportunities to gain self-confidence and autonomy, exercise social skills, and engage in spontaneous activities such as play (Weir, 2023). To escort the child on the school journey also entails a time commitment and planning ahead for the caregivers, which is a barrier for many parents (Zuniga, 2012). Ideas such as the walking school bus respond to the need for safe active travel while reducing the time commitment for parents. At the neighbourhood level, a group of children, accompanied by two adults, a "driver" at the front and a "conductor" at the back, walk on a set route picking up additional "passengers" at specified stops along the way. Walking school buses provide a structured means of active travel, yet the walking they facilitate is itself a highly supervised and controlled means of transport (Kearns et al., 2003).

2. Children's Mobility Patterns, Their Wellbeing, and Urban Sustainability

Children's active travel and autonomous mobility are both linked with their wellbeing. Wellbeing is a holistic concept, albeit elusive in its definition (Jarden & Roache, 2023). In the case of children, the term "wellbeing" is defined by indicators of material wellbeing, based on objective data, and by subjective indicators, based on individuals' personal evaluation. Within the domain of material wellbeing, indicators of low wellbeing include living under the poverty line, living in homes with few education resources, and lack of employment of parent-adult, while subjective indicators refer to aspects of life such as social connections, perceived quality of life, and sense of life satisfaction (Statham & Chase, 2010). Wellbeing is also connected with the learning opportunities of the child and the financial situation of the child's family (Waygood et al., 2017), as well as with the rights of the child (Statham & Chase, 2010). UNICEF (2020) applied a multi-faceted approach to measure children's wellbeing in 38 developed countries, incorporating children's mental wellbeing, physical wellbeing, and skills for life, which include basic academic and social skills. Although children's mobility mode is not one of the variables studied, the UNICEF report found strong links between happiness and the frequency of playing outside, which is an activity that is supported when CIM levels are high (Weir, 2023). For example, Rissotto and Tonucci (2002) found that children who go to school on their own are more likely to be allowed to go and play outside with their friends than the ones who are driven by car or accompanied on foot. The differences in happiness between children who rarely played outside and those who did so daily were found to be substantial—"more than 1 point on a happiness scale of 0 to 10 (from least to most happy)—in almost every country" (UNICEF, 2020, p. 21).

In their comparative study in 16 countries, Shaw et al. (2015) found a positive correlation between the level of CIM and the country's UNICEF ranking in children's wellbeing. In an integrative review, Waygood et al. (2017) investigated the link between transport mode and children's wellbeing. Results showed that mode of transport plays a role in all domains (cognitive, psychological, physical, social, and economic) of children's wellbeing, with active travel and independent travel having a positive correlation, while most negative impacts are associated with traffic. Empirical studies on how children's mobility patterns influence their wellbeing show that children living in environments that allow them to get around in active and independent ways benefit psychologically and socially and have greater levels of wellbeing (Leung & Loo, 2017; Ramanathan et al., 2014; Stark et al., 2018; Weir, 2023; Westman et al., 2013). In a pan-Canadian study, Ramanathan et al. (2014) found that AST relates to self-reported emotional benefits and a higher degree of feelings of happiness compared to passive modes of transport. Children and parents who travel by car and other forms of passive travel are significantly more likely to experience negative emotions like feeling rushed or tired. Westman et al. (2013) also reported higher levels of pleasure in children who used active mode of school commute. Weir (2023) found that the level of autonomous mobility is linked with children's sense of wellbeing, as it relates positively to the amount and quality of time they spend actively in their neighbourhood for either travel or play, their confidence in getting around, and their sense of control in the use of their neighbourhood.

Children's mobility patterns have a profound effect on their quality of life but also on the overall sustainability of cities. Sustainability combines economic development, social development, and environmental protection with full respect for all human rights and fundamental freedoms (UN-Habitat, 1996). Children's mobility choices, as a collective behaviour, influence the environment (Wu et al., 2020), the economy (Pojani & Boussauw, 2014), and the wellbeing of the community (Ramanathan et al., 2014). Although extensive sociological and environmental research highlights how urban environments and the

form of cities influence sustainable mobility and vice versa, less emphasis has been given to the role of children's mobility in this trend, as well as how it impacts carbon emissions in a city (Gilbert et al., 2017). While many studies connect the rising use of the private automobile with several illnesses in children (i.e., diabetes, obesity, and cardiological problems), its long-term impact on attitudes that will accompany children when they become adults has not been sufficiently examined (Gilbert et al., 2017). By being driven from a small age in the back seat of a car, often for trips of very short distance, children acquire habits that are contrary to the current quest for more sustainable and emissions-free urban environments through the promotion of active travel and use of public transportation (Cook, 2019).

Although there are fluctuations in the degree of independent mobility among various countries, studies show there are common trends that relate the decline of CIM to an increase of fear for children's safety (Leung & Loo, 2017). Indeed, safety concerns, especially traffic danger, seem to be a crucial factor for parents to be reluctant to allow their children to travel independently (Ridgewell et al., 2009). Statistics confirm these parental fears. Traffic accidents are the leading cause of death for the age group 0–24 in the European Union (Sethi et al., 2007). Counterintuitively, to protect children from traffic danger, parents often choose to drive them to school. Apart from being a passive mode of travel, the use of cars for the daily commute to school raises the risk of accidents for children walking or biking, since the volume of traffic in children's routes to school is much bigger (United States Department of Transportation, 2004). Private cars also increase ambient local concentrations of pollutants in school areas (Adams & Requia, 2017). Addressing the need to reduce car usage, Safe Routes to School is a federal-budget-funded program that aims at strengthening children's ability to travel to school safely and actively (United States Department of Transportation, 2004). The emphasis is on active, not necessarily independent travel. Children may be accompanied by adult guards along the route, as in the case of walking school buses.

The multi-faceted importance of children's mobility both for children themselves and for the society and the communities they live in has led to a growing volume of research in the past four decades (Gaster, 1992; Hillman et al., 1990; Pooley et al., 2010; Shaw et al., 2015), including comparative studies that document the decrease in children's active and independent mobility through time in various countries (Babb et al., 2017; Prezza et al., 2001; Schoeppe et al., 2016). In Greece, however, research in this field is much less advanced. Basic data on how children move, at local and national level, are missing, as no national survey on children's mobility has ever been conducted. We only found very few studies on school travel in different geographical regions of the country. In her doctoral dissertation, Kotoula (2021) investigated school mobility patterns of students attending public primary and high schools in eight municipalities of the greater urban area of Thessaloniki, as reported by their parents. Tampaki et al. (2023) studied the mobility modes of high school students in the small town of Orestiada, emphasizing how the use of bicycles could be promoted. In his graduate thesis, Karakatsanis (2010) studied the relationship between AST and levels of physical activity in students aged 11–18 on the island of Samos. In Greece, traffic accidents with children victims are common, thus fear of traffic keeps an increasing proportion of parents away from allowing their children to walk or cycle on their own (Katsavounidou, 2021). At the same time, children's safety is, sadly, connected to the perceived need to “educate children” on traffic rules instead of questioning the problematic environmental conditions and social behaviour that create traffic danger. As Waygood et al. (2017) point out, however, children should not be “burdened with the responsibility of road safety when they are not the ones creating it” (Waygood et al., 2017, p. 47).

This article's study area is the municipality of Kordelio-Evosmos in the western part of the greater urban area of Thessaloniki. Kordelio-Evosmos has one of the highest percentages of children and youth among Greek cities, having attracted mainly young families during the past two decades. We hypothesised that it would have more child-friendly characteristics than other urban areas whose populations have been shrinking in the same period. We aimed to gather data about how children commute to school and to examine how parental attitudes on school travel correlate with the level of sustainability of the urban environment, and especially the conditions of the pedestrian landscape in their neighbourhood. At the beginning of our study, given the lack of previous data, we were interested in both concepts, AST and CIM, as there was uncertainty regarding the nature of the problem: In a densely built, compact city such as Kordelio-Evosmos, which has many positive characteristics such as short distances between destinations and mixed uses, should the focus be on children's autonomy (independent mobility) or on promoting active travel? To make this decision, basic data on school commutes were needed. Thus, in this article we refer to "mobility patterns" regarding children's school travel, keeping in mind the differences between "active" and "independent" mobility, which we take into account in the discussion of our findings.

3. Research Design

3.1. Study Area

The municipality of Kordelio-Evosmos is one of the seven municipalities comprising the greater urban area of Thessaloniki, which is the second most populated urban agglomeration in Greece with a population of 802,392 (Hellenic Statistical Authority, 2023). The study area is located about five kilometres to the northwest of the historic centre of Thessaloniki (Figure 1).

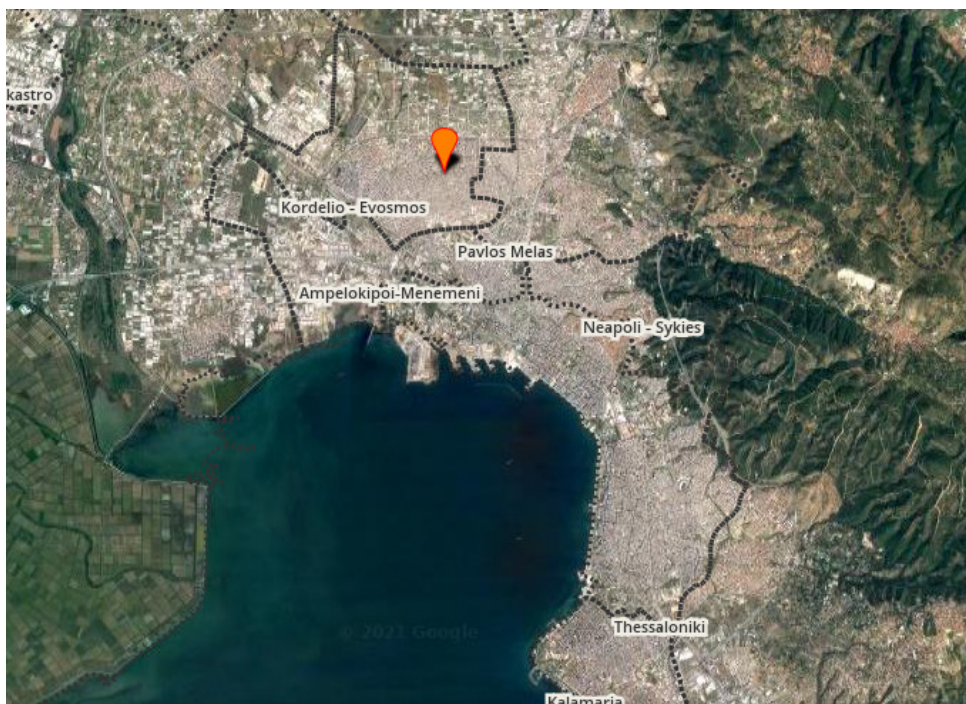


Figure 1. Aerial view of the greater urban area of Thessaloniki showing the location of the municipality of Kordelio-Evosmos. Source: Authors based on Oikoskopio (2024).

Kordelio-Evosmos has a population of 105,426 inhabitants according to the 2021 census (Hellenic Statistical Authority, 2023), covering an area of about 14 square kilometres. The municipality grew in terms of population between 2001 and 2011 at a rate of 31%, which was the second-greatest growth rate among cities in the country, and by 3.48% in the 2011–2021 period. In terms of age demographics, Kordelio-Evosmos is also the second “youngest” city in the country. According to the 2011 Census, the age group 0–14 years represented 19% of the total population (19,333 individuals), thus also lowering the median age of the inhabitants to 35.9 years, while the national median age is 41.9 years (Municipality of Kordelio-Evosmos, 2016). For reasons of comparison, in the case of the municipality of Thessaloniki, the 0–14 age group represents a mere 10.36% of the population (Katsavounidou & Kourti, 2019). One could say that the dominant characteristic of the city of Kordelio-Evosmos is indeed its “youthful” character.

Geographically, Kordelio-Evosmos is located in proximity to the industrial zone of Western Thessaloniki and is traversed by major traffic axes, of metropolitan importance, as well as the railroad tracks leading to the main train station of Thessaloniki. The construction of new multi-story apartment buildings (*polykatoikia* in Greek) at affordable prices, as well as the easy access by car both to the centre and to the periphery of Thessaloniki, have rendered the area attractive for new families of lower- and middle-class socioeconomic status, thus explaining the population growth (Katsavounidou & Kourti, 2019). The built environment of the municipality, mainly in its central part, has distinct compact-city features, which are common in typical Greek cities and towns: high density, mixed uses, narrow street network, and lack of green and open spaces. These characteristics contribute to short distances between everyday destinations and amenities, especially at neighbourhood level. On the negative side, lack of parking spaces and car-dependent lifestyles often result in sidewalks being too narrow or occupied by parked cars.

The total number of elementary school children was 7,626 during the 2019–2020 academic year, in a total of 33 public elementary schools operating within municipal borders. With few exceptions, schools are located in the most densely built parts of the municipality (Figure 2).

3.2. Sample

We used a structured questionnaire addressed to parents of elementary school children (aged 6 to 12 years old). Asking parents about the characteristics of their children’s mobility patterns is common in the literature (Mah et al., 2017; Mehdizadeh et al., 2016; Pojani & Boussauw, 2014; Wilson et al., 2018; Zuniga, 2012). The survey took place between May 25 and June 10, 2020, through Google Forms, at a time when restrictions due to the Covid-19 pandemic had been partially lifted and children had returned to physical classes.

We contacted the administrators of parents and guardians associations via email, asking them to distribute the invitation to participate in the survey to their members. Our sample was random, as it was based on the responses we received. No official permission to conduct the research was needed since school administrators were not involved in the process. From an ethical point of view, participants stated their agreement to participate in the survey at the beginning of the questionnaire.

In total, 97 parents completed the survey. These 97 responses corresponded to 103 students, as 6 parents had more than one child attending the same school. Out of the 33 elementary schools in the municipality, responses came from 27 schools (81.81%). The number of responses per school varied from 1 to 18.

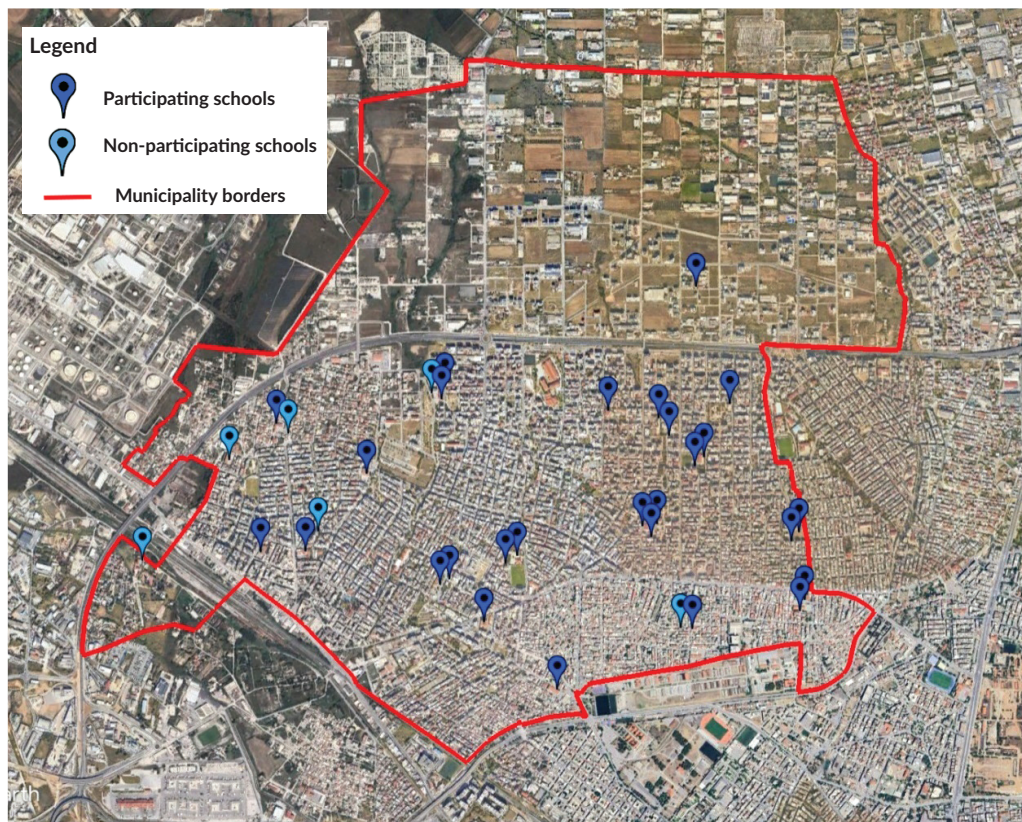


Figure 2. Satellite map of the municipality of Kordelio-Evosmos showing the locations of the elementary schools. Source: Authors based on Google Earth.

The geographical distribution of schools from which responses were gathered covers a large part of the total area of the municipality (Figure 2).

3.3. Questionnaire and Method

The questionnaire was based on the Safe Routes to School survey methodology (United States Department of Transportation, 2004). It contained 26 questions, organised into three groups. The first group included questions about children's age and gender, distance between home and school, duration of the journey, and children's mode of travel to and from school. In the second set of questions, parents were inquired about their child's expressed wish to travel autonomously, the parameters related to their decisions about their child's school travel, and the perceived benefits of AST for children's wellbeing in terms of pleasure and health benefits. The third part of the survey included questions regarding how parents evaluate the urban environment of their neighbourhood, in terms of quality of open space, pedestrian infrastructure, and traffic conditions.

Descriptive analysis was conducted using Microsoft Excel. To identify factors influencing children's school travel mode, statistical analysis was performed using the software GNU PSPP 1.4.1. We used ANOVA analysis to examine differences across groups based on categorical variables such as age, gender, and distance from school. The F statistics and corresponding p values were analysed to determine the statistical significance of the differences observed.

4. Results

The age of children ($n = 103$) whose parents ($n = 97$) participated in the survey ranged from 6 to 12 years old: 4 were 6 years old (3.88%), 24 were 7–8 years (23.30%), 46 were 9–10 years (44.66%), and 29 were 11–12 years (28.16%). No significant difference in gender representation was noticed; girls represented 52% of the total.

To assess the proximity between home and school, parents were asked to report the approximate distance in meters and the walking time this journey takes. Regarding distance between home and school, most children (89.7%) live within a radius of 1,000 meters or less (Figure 3). Parents reported that 91.7% of families live within a walking distance of 10 minutes from school and 52.6% within an even shorter distance (5 minutes or less).

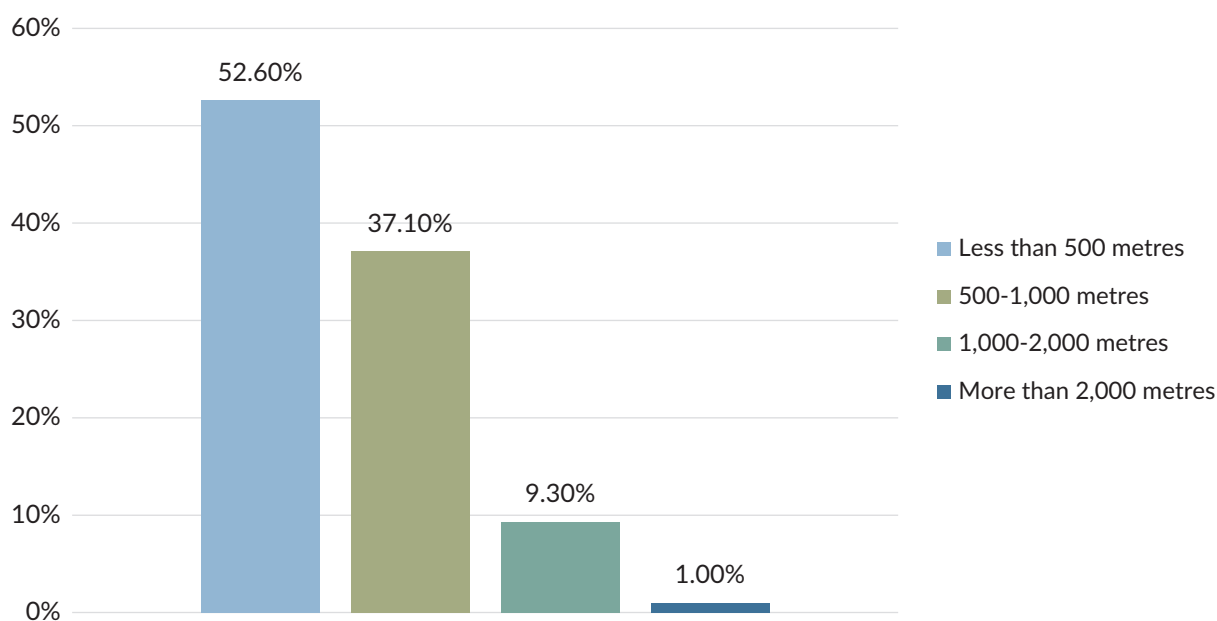


Figure 3. Chart showing results regarding the distance between home and school, according to parents' answers. Most children (89.7%) live within a radius of 1,000 meters or less from school.

Walking is the only means of active travel that was reported. No one travels by bicycle, which is probably due to the complete absence of bicycle infrastructure in the area. The only means of motorised travel appears to be private cars, driven by parents. Greek public schools do not have school buses, and no one reported using public transport. It is noteworthy that there were differences in the mode of commute between the journey from home to school and the return journey (Table 1).

Overall, walking prevails (66.5%), but only 14.08% of children walk without adult escort. More specifically: 15.53% of the children go to school on foot on their own and 12.62% return home in the same manner. Almost half of the children, 49.51%, walk to school accompanied by an adult, and 55.34% return home in this mode. About one out of three children commute in their parents' car: 34.95% on the way to school, 32.04% on the return trip. In the 9–12 age group, there are only slight differences compared to the whole sample: 20.39% walk alone, 45.39% walk with an adult escort, and 34.21% are driven by car. In the oldest

Table 1. Children’s mode of commute to school, in the two journeys (to and from school), for all ages (6–12), for the group 9–12 years, and the group 11–12 years.

Mode of child's school travel	Home-to-school journey			School-to-home journey			Median (%)		
	6–12 years	9–12 years	11–12 years	6–12 years	9–12 years	11–12 years	6–12 years	9–12 years	11–12 years
Active mode On foot, without adult escort	16	16	13	13	15	12	14.08	20.39	43.10
	(15.53%)	(21.05%)	(44.83%)	(12.62%)	(21.05%)	(34.48%)			
On foot, with adult escort	51	32	10	57	37	14	52.42	45.39	41.38
	(49.51%)	(42.11%)	(41.38%)	(55.34%)	(42.11%)	(48.28%)			
Passive mode By car, driven by parent	36	28	6	33	24	3	33.50	34.21	15.52
	(34.95%)	(36.84%)	(20.69%)	(32.04%)	(36.84%)	(10.34%)			

group (11–12 years), the percentage of children who walk alone is quite high (43.10%), however parents’ involvement in the commute remains high: 41.38% walk with an adult escort, and 15.52% are driven by car.

Asked how they would characterise their child’s experience if the daily commute to school was done or could be done (if conditions changed) on foot or by bicycle, 87.6% of parents agreed that it would be a pleasant or very pleasant experience for the child (Figure 4); 93.9% also agreed that it would have a positive impact on their children’s health.

In the multiple-choice question about the parameters parents take into account in their decision about children’s commute to school, safety from violence and crime (88.66%) and safety from traffic (87.63%) were

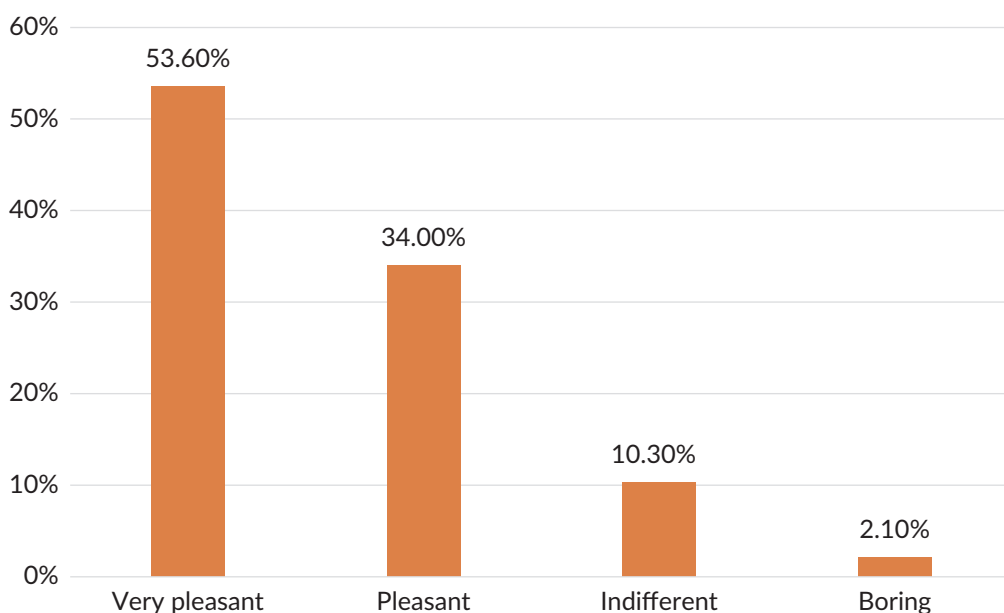


Figure 4. Chart showing results regarding parents’ replies to the question “How would you characterise your child’s experience if the daily commute to school was done or could be done (if conditions changed) on foot or by bicycle?”

the most common answers, followed by vehicular speed (85.57%), safety to cross streets (83.51%), existence and quality of sidewalks (78.35%), and load of traffic (77.32%).

The final part of the survey contained questions about the environmental conditions in the neighbourhood. Regarding overall quality of conditions for walking, 85.4% of respondents assessed them as bad or mediocre (“very bad,” “with many problems,” “with some problems”). More specifically, Table 2 shows which problems related to the quality of open space, pedestrian infrastructure, and traffic conditions were considered more prominent. Regarding the quality of open space, lack of greenery (76%), insufficient public lighting (61.5%), and dirtiness (58.3%) appear as the most problematic. Regarding pedestrian infrastructure, absence (72.9%), poor maintenance (63.5%), and narrowness (55.2%) of sidewalks were the most common replies. Regarding overall traffic conditions, 79.2% of the parents replied that these are bad and difficult for pedestrians. In specific, drivers’ behaviour was assessed as problematic (93%), as parents reported speeding in residential areas (85.4%), violations of pedestrians’ right of way (81.3%), and even violations of red traffic lights (43.8%).

Table 2. Parents’ assessment of problematic aspects of the built environment.

Problems in the built environment of the neighbourhood		Responses (%)
Quality of open space	Lack of greenery	76
	Insufficient public lighting	61.5
	Rubbish	58.3
	Air pollution	51
	Poor quality of spaces for walking	49
	Lack of public spaces	33.3
Pedestrian infrastructure	Absence of sidewalks	72.9
	Poor maintenance	63.5
	Sidewalks too narrow	55.2
	Obstacles on sidewalks	53.1
	Lack of ramps	53.1
Traffic conditions	Problematic drivers’ behaviour	93
	High speeds	85.4
	Violation of pedestrian’s right of way	81.3
	Parked cars obstructing visibility for pedestrians	74
	Absence of traffic signs	66.7
	Violation of red traffic lights	43.8

Statistical analysis was conducted to investigate the relationships between children’s mode of school travel (independent variable) and responses to nine selected questions. These questions pertained to (a) the age and the gender of the child, (b) the distance between home and school, (c) parental permission to independent travel, (d) the parent’s perceptions of the impact on the wellbeing of the child (pleasure from travelling actively to school, positive impact on the child’s health), and (e) the parent’s assessment of route conditions (safe crossings, drivers’ behaviour, pleasant conditions for walking in the neighbourhood). As our data showed differences in the mode of travel *to* and *from* school, we took into account the mode of the return journey (departure from school). A one-way ANOVA was utilised to assess differences across groups.

Table 3. One-way ANOVA results examining the relationship between children's mode of school travel (on the return journey) and various factors.

Variable		Sum of squares	df	Mean square	F	p (sig.)
Child's age	between-groups	34.57	2	17.29	7.10	.001
	within-group	228.77	94	2.43		
	total	263.34	96			
Child's gender	between-groups	.11	2	.05	.21	.812
	within-group	24.14	94	.26		
	total	24.25	96			
Distance from home to school	between-groups	5,565,951	2	2,782,976	13.07	.000
	within-group	20,016,523	94	212,941.7		
	total					
Permission to travel independently	between-groups	6.93	2	3.46	25.08	.000
	within-group	12.99	94	.14		
	total	19.92	96			
Child's feeling of pleasure from active travel	between-groups	.05	2	.02	.04	.959
	within-group	55.06	94	.59		
	total	55.11	96			
Positive effect on child's health	between-groups	.01	2	.01	.01	.987
	within-group	39.66	94	.42		
	total	39.67	96			
Safe to cross streets	between-groups	1.51	2	.75	4.89	.010
	within-group	14.33	93	.15		
	total	15.83	95			
Drivers' behaviour	between-groups	.15	2	.08	1.30	.277
	within-group	5.47	93	.06		
	total	5.63	95			
Pleasant conditions for walking	between-groups	.21	2	.11	.90	.409
	within-group	11.03	93	.12		
	total	11.24	95			

The F statistics and corresponding p values were examined to determine the statistical significance of the observed differences (see Table 3).

The analysis revealed that the age of the child was significantly correlated with the choice of travel mode ($F = 7.10$, $p < .05$). In contrast, gender did not show a significant correlation with travel mode ($F = .21$, $p = .812$). The distance from home to school demonstrated a very strong correlation with the mode of travel ($F = 13.07$, $p = .000$). The highest correlation was observed between the mode of travel and the variable "parents' agreement to give permission for the child to travel independently" ($F = 25.08$, $p = .000$). Additionally, a significant correlation was found with parents' assessment about whether or not the neighbourhood provides safe crossings ($F = 4.89$, $p = .010$). All other variables, including parents' views on the child's feeling of pleasure from active travel, the health effects of active travel, drivers' behaviour, and the pleasantness of conditions for walking, showed statistically non-significant correlations.

5. Discussion

In terms of mode of school travel (Table 1), our sample shows a relatively high percentage of AST: 65.04% of the children walk the route from home to school and 67.96% from school to home (median 66.50%). Johansson et al. (2012) mention that studies from European countries, e.g., Sweden, Estonia, Switzerland, the UK, Denmark, the Netherlands, and Spain, report rates ranging from 50% to 85%; therefore, Kordelio-Evosmos stands somewhere in the median. However, in our study, the percentage of children who walk with an adult escort is 52.42%, very high compared to findings from other countries. More specifically, we found that 47.87% of the children of 9–10 years walk with an adult, while in a Swiss study, only 7.5% of children in the same age group were accompanied by an adult (Bringolf-Isler et al., 2008). One could hypothesise that the age threshold for independent mobility is higher in Greece, but that is not the case, because in our study, even within the group of children of 11–12 years, 41.38% walk the school route with an adult companion. Although distances are short (Figure 3), parents do not seem confident in allowing children to walk alone, even when children have reached middle childhood, an age considered to be a threshold for independent mobility (Jones & Cunningham, 1999).

Statistical analysis (Table 3) showed that the choice of school travel mode is highly correlated to parental agreement to allow the child to walk on their own, confirming that parents' sense of safety determines school travel mode (Mah et al., 2017). Other attributes we found to be statistically related to children's school travel patterns are the child's age and distance between home and school, as previous studies have found (Shaw et al., 2013). The environmental variable that showed the strongest statistical correlation with children's travel mode is the safety of crossing streets. Parents point to unsafe crossings as a major problem along the school route and raise concerns about the overall traffic conditions, as previous studies have also found. Swain et al. (2024) concluded that the fear of traffic accidents among parents influences AST to a greater degree than the distance from home to school and stranger danger. Features such as raised crossings are missing from Kordelio-Evosmos, while research has shown that controlled crossings, such as signalised crossings and zebra crossings, especially if they are raised, are perceived as important for safety (Swain et al., 2024). In line with recent studies (Duffy et al., 2024; Wangzom et al., 2023), our findings confirm that traffic, negative perceptions of safety, and speeding vehicles are all identified by parents as reasons to restrict their child's movement.

Our results showed that parents perceive AST to be beneficial to their children, in terms of their health and experiencing of pleasant feelings (Figure 4), confirming previous research that shows the strong association between AST and children's sense of wellbeing. Overall, positive emotions (both of parent and child) were documented when school travel is done actively (Ramanathan et al., 2014).

In terms of neighbourhood walkability, 85.4% of the parents found walking conditions to be bad or mediocre. Literature suggests that parents who allow their children to walk to school generally perceive walking conditions as more comfortable and convenient, compared to parents whose children commute by non-walking means (Mehdizadeh et al., 2016). This was partially confirmed in our study. Among parents who had a favourable view of the neighbourhood, the use of cars was not differentiated from the general sample (35.71% against 33.50%). However, they did allow their children to walk autonomously more (52.42% against 28.57%).

Specific findings from the part of the study that asked parents to assess the quality of urban space, pedestrian infrastructure, and traffic conditions (Table 2) revealed widespread dissatisfaction among parents regarding the urban environment of Kordelio-Evosmos, especially regarding drivers' behaviour, insufficient sidewalks, and lack of greenery. These findings paint a bleak picture of a highly unsustainable urban environment in Kordelio-Evosmos, a city paradoxically noted for having one of the highest percentages of children and youth populations in the country.

Kotoula (2021) investigated the commuting patterns of Greek children in different districts within the greater urban area of Thessaloniki, revealing significant differences compared to our findings in Kordelio-Evosmos. In Kotoula's study, only 60.7% of children lived within a radius of 1,000 meters from their school, whereas in Kordelio-Evosmos, this percentage was 89.7%. Furthermore, the use of cars for the school commute was lower in Kordelio-Evosmos (33.5%) compared to the broader greater urban area of Thessaloniki (43.4%). These differences suggest that there is a need for further comparative studies on children's mobility patterns, particularly among areas of different socioeconomic characteristics and urban typologies. It is important to note that Kordelio-Evosmos represents a typical example of a Greek urban housing area with compact-city characteristics. Low- and middle-class housing areas in Greece, including Kordelio-Evosmos, are characterised by urban conditions similar to those found in other less-developed European regions, such as Albania. In these areas, beyond pedestrianised downtown areas, there are often poor environmental conditions, such as air, noise, and visual pollution (e.g., from traffic and parking), as well as inadequate urban design that creates spaces unfriendly to walking (Pojani & Boussauw, 2014).

6. Conclusion

Given the scarcity of research on children's mobility patterns in Greece, this study first and foremost provides a set of data on how elementary school children commute to school in a densely populated and compact-city Greek urban environment such as Kordelio-Evosmos. In parallel, we analyse the factors influencing parents' choices regarding school commute and relate them with their overall assessment of the neighbourhood environment.

Our study has some limitations. It was conducted during the Covid-19 pandemic; when the questionnaire survey took place, schools had just reopened after two months of lockdown. The sample was random and rather small. It was addressed to parents only, while other studies (Lee et al., 2013) point out the need to ask both children and parents about their opinions on the choice of travel mode and on the conditions of the route. Given the total absence of basic data on school travel at a national level, our findings cannot be compared to previous ones in other Greek cities or towns. If such data existed, we would be able to investigate historical trends in Greek children's travel modes, differences attributed to diverse urban typologies, and differences between cities. It would be interesting, for example, to compare Kordelio-Evosmos to other cities, such as Trikala, which boasts a unique tradition of cycling among Greek regions and where bicycle use by children and youth is common.

Seen through the dichotomy of "active" versus "independent" travel, as we explain in the Introduction, the results of our study show that, in the case of Kordelio-Evosmos, 66.5% of children travel to school actively (on foot) but not independently (only 14.08% walk on their own). This occurs despite the short distances between home and school (less than 1,000 meters). We cannot conclusively infer from the survey the reasons

why parents prefer to escort their children on their walking trip. Our findings indicate that parents' concerns about safety dangers along the route related to violence and crime and to traffic play a role, especially vehicular speeds and lack of safety to cross streets. Previous studies have found that perceptions of road safety are the key barrier, rather than fear of strangers or distance from school (Zuniga, 2012). The decision to escort could also be attributed to parenting styles that value adult supervision as "good parenting," possibly related to cultural norms about the "vulnerable" child who is "at risk" in public space (Kearns et al., 2003); however, that would be an issue for more in-depth research.

We chose Kordelio-Evosmos for our field study based on the fact that this city is one of the "youngest" in the country, with almost one out of five inhabitants belonging to the age group of 0–14 years. One would expect, given its demographic profile, that Kordelio-Evosmos would offer plenty of good public spaces, along with safe conditions for walking. We found that parents of elementary school children evaluate the conditions of the built environment negatively, not only for their children's school travel but also in terms of the overall environmental quality of urban space. The results of this study highlight parents' worries about the problematic aspects of urban space in relation to safety along the school route. The physical characteristics of the urban environment that inhibit CIM (i.e., poor design of pedestrian infrastructure) are unfortunately combined with the antisocial and life-threatening behaviour of drivers, such as violation of speed limits, illegal parking on sidewalks, and violation of pedestrians' right of way. This combination of environmental and social factors renders the urban environment unsafe and unfriendly for children, obliging parents to accompany them to school on foot or to drive them there by car, having a high toll both on the wellbeing of children and on urban sustainability in general.

In local policy, we think that the issue of active and, even better, independent school travel is highly relevant in this city, and, in our opinion, it should be a priority for local authorities and citizen groups. The already high percentage of walking to school, with or without the company of a guardian, is promising for the implementation of ideas such as the walking school bus, in parallel to infrastructure interventions such as widening of sidewalks and raised crossings. As Greek cities and towns have recently started the process of drafting sustainable urban mobility plans, our findings could inform proposals, especially in areas around schools. Provisions for better pedestrian infrastructure and for safer streets should be included in those plans, ensuring that children have the opportunity to travel safely, actively, and independently, alongside promoting walkability in general. For a better environment for the children and for attaining urban sustainability, Greek cities should invest in pedestrian infrastructure, in parallel to implementing coordinated measures related to drivers' behaviour such as strict enforcement of traffic laws and education.

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Conflict of Interests

The authors declare no conflict of interests.

References

Adams, M. D., & Requia, W. J. (2017). How private vehicle use increases ambient air pollution concentrations at schools during the morning drop-off of children. *Atmospheric Environment*, 165, 264–273. <https://doi.org/10.1016/j.atmosenv.2017.06.046>

- Babb, C., Olaru, D., Curtis, C., & Robertson, D. (2017). Children's active travel, local activity spaces and wellbeing: A case study in Perth, WA. *Travel Behaviour and Society*, 9, 81–94. <https://doi.org/10.1016/j.tbs.2017.06.002>
- Bringolf-Isler, B., Grize, L., Mäder, U., Ruch, N., Sennhauser, F. H., & Braun-Fahrländer, C. (2008). Personal and environmental factors associated with active commuting to school in Switzerland. *Preventive Medicine*, 46(1), 67–73. <https://doi.org/10.1016/j.ypmed.2007.06.015>
- Convention on the Rights of the Child, 1989. <https://www.unicef.org.uk/what-we-do/un-convention-child-rights>
- Cook, H. (2019, January 29). 'Back-seat generation': Time-poor parents choose the car over a 10-minute walk to school. *The Age*. <https://www.theage.com.au/national/victoria/back-seat-generation-time-poor-parents-choose-the-car-over-a-10-minute-walk-to-school-20190129-p50udy.html>
- Duffy, R. T., Larsen, K., Bélanger, M., Brussoni, M., Faulkner, G., Gunnell, K., Tremblay, M. S., & Larouche, R. (2024). Children's independent mobility, school travel, and the surrounding neighborhood. *American Journal of Preventive Medicine*, 66(5), 819–831. <https://doi.org/10.1016/j.amepre.2023.12.002>
- Faulkner, G. E. J., Buliung, R. N., Flora, P. K., & Fusco, C. (2009). Active school transport, physical activity levels and body weight of children and youth: A systematic review. *Preventive Medicine*, 48(1), 3–8. <https://doi.org/10.1016/j.ypmed.2008.10.017>
- Faulkner, G. E. J., Richichi, V., Buliung, R. N., Fusco, C., & Moola, F. (2010). What's "quickest and easiest?": Parental decision making about school trip mode. *International Journal of Behavioral Nutrition and Physical Activity*, 7(1), Article 62. <https://doi.org/10.1186/1479-5868-7-62>
- Gaster, S. (1992). Historical changes in children's access to U.S. cities: A critical review. *Children's Environments*, 9(2), 34–55.
- Gilbert, H., Whitzman, C., Pieters, J., & Allan, A. (2017). Children and sustainable mobility: Small feet making smaller carbon footprints. *Australian Planner*, 54(4), 234–241. <https://doi.org/10.1080/07293682.2018.1480500>
- Hellenic Statistical Authority. (2023). *Results of census of population and residences (ELSTAT 2021)*. <https://www.statistics.gr/2021-census-pop-hous-results>
- Hillman, M., Adams, J., & Whitelegg, J. (1990). *One false move...: A study of children's independent mobility*. Policy Studies Institute.
- Jarden, A., & Roache, A. (2023). What Is wellbeing? *International Journal of Environmental Research and Public Health*, 20(6), Article 5006. <https://doi.org/10.3390/ijerph20065006>
- Johansson, K., Laflamme, L., & Hasselberg, M. (2012). Active commuting to and from school among Swedish children—A national and regional study. *European Journal of Public Health*, 22(2), 209–214. <https://doi.org/10.1093/eurpub/ckr042>
- Jones, M., & Cunningham, C. (1999). The expanding worlds of middle childhood. In E. K. Teather (Ed.), *Embodied geographies: Spaces, bodies, and rites of passage* (pp. 27–41). Routledge.
- Karakatsanis, K. (2010). *I energitiki metakinisi ton mathiton pros to scholeio: Epidrasi sti fysiki tous drastiriotita* [Unpublished master's thesis]. University of Thessaly. <https://doi.org/10.26253/heal.uth.2315>
- Karsten, L., & Van Vliet, W. (2006). Children in the city: Reclaiming the street. *Children, Youth and Environments*, 16(1), 151–167.
- Katsavounidou, G. (2021). Children's safe and sustainable independent mobility: A comparison of international practices and the situation in Greece. In E. G. Nathanail, G. Adamos, & I. Karakikes (Eds.), *Advances in mobility-as-a-service systems: Proceedings of 5th Conference on Sustainable Urban Mobility, Virtual CSUM2020, June 17–19, 2020, Greece* (pp. 539–549). Springer. https://doi.org/10.1007/978-3-030-61075-3_53

- Katsavounidou, G., & Kourti, P. (2019). Chroniko mias proanagkeltheisas exodou: I astiki syrriknosi tis Thessalonikis. In E. Athanasiou & C. Christodoulou (Eds.), *Praktika Diethnous Dipiestimonikou Synedriou "Poli ypo kataskevi: schedia, diadikasies kai praktikes gia ton choro tis Thessalonikis"* (pp. 40–50). University Studio Press.
- Kearns, R. A., Collins, D. C. A., & Neuwelt, P. M. (2003). The walking school bus: Extending children's geographies? *Area*, 35(3), 285–292. <https://doi.org/10.1111/1475-4762.00177>
- Kotoula, K. M. (2021). *Investigating factors affecting the mode choice in school trips* [Unpublished doctoral dissertation]. Democritus University of Thrace. <https://www.didaktorika.gr/eadd/handle/10442/49378?locale=en>
- Larouche, R., Saunders, T. J., John Faulkner, G. E., Colley, R., & Tremblay, M. (2014). Associations between active school transport and physical activity, body composition, and cardiovascular fitness: A systematic review of 68 studies. *Journal of Physical Activity and Health*, 11(1), 206–227. <https://doi.org/10.1123/jpah.2011-0345>
- Lee, C., Zhu, X., Yoon, J., & Varni, J. W. (2013). Beyond distance: Children's school travel mode choice. *Annals of Behavioral Medicine*, 45(Suppl. 1), 55–67. <https://doi.org/10.1007/s12160-012-9432-z>
- Leung, K. Y. K., & Loo, B. P. Y. (2017). Association of children's mobility and wellbeing: A case study in Hong Kong. *Travel Behaviour and Society*, 9, 95–104. <https://doi.org/10.1016/j.tbs.2017.07.004>
- Mah, S. K., Nettlefold, L., Macdonald, H. M., Winters, M., Race, D., Voss, C., & McKay, H. A. (2017). Does parental support influence children's active school travel? *Preventive Medicine Reports*, 6, 346–351. <https://doi.org/10.1016/j.pmedr.2017.04.008>
- Mammen, G., Faulkner, G., Buliung, R., & Lay, J. (2012). Understanding the drive to escort: A cross-sectional analysis examining parental attitudes towards children's school travel and independent mobility. *BMC Public Health*, 12(1), Article 862. <https://doi.org/10.1186/1471-2458-12-862>
- Mammen, G., Stone, M. R., Buliung, R., & Faulkner, G. (2015). "Putting school travel on the map": Facilitators and barriers to implementing school travel planning in Canada. *Journal of Transport & Health*, 2(3), 318–326. <https://doi.org/10.1016/j.jth.2015.05.003>
- McMillan, T. E. (2007). The relative influence of urban form on a child's travel mode to school. *Transportation Research Part A: Policy and Practice*, 41(1), 69–79. <https://doi.org/10.1016/j.tra.2006.05.011>
- Mehdizadeh, M., Mamdoohi, A. R., Zavareh, M. F., & Nordfjærn, T. (2016). The role of parental attitudes towards walking on children walking to schools. *Journal of Traffic and Logistics Engineering*, 4(2), 108–112.
- Municipality of Kordelio-Evosmos. (2016). *Strategic business plan of the municipality of Kordelio-Evosmos 2016–2019*.
- O'Brien, C. (2001). *Ontario walkability study: Trip to school, children's experiences and aspirations*. York University.
- Oikoskopio. (2024). *Oikoskopio: Xartis*. <http://oikoskopio.gr/map>
- Pojani, D., & Boussauw, K. (2014). Keep the children walking: Active school travel in Tirana, Albania. *Journal of Transport Geography*, 38, 55–65. <https://doi.org/10.1016/j.jtrangeo.2014.05.012>
- Pooley, C., Whyatt, D., Walker, M., Davies, G., Coulton, P., & Bamford, W. (2010). Understanding the school journey: Integrating data on travel and environment. *Environment and Planning A: Economy and Space*, 42(4), 948–965. <https://doi.org/10.1068/a41405>
- Prezza, M., Pilloni, S., Morabito, C., Sersante, C., Alparone, F. R., & Giuliani, M. V. (2001). The influence of psychosocial and environmental factors on children's independent mobility and relationship to peer frequentation. *Journal of Community & Applied Social Psychology*, 11(6), 435–450. <https://doi.org/10.1002/casp.643>
- Ramanathan, S., O'Brien, C., Faulkner, G., & Stone, M. (2014). Happiness in motion: Emotions, well-being, and active school travel. *Journal of School Health*, 84(8), 516–523. <https://doi.org/10.1111/josh.12172>

- Ridgewell, C., Sipe, N., & Buchanan, N. (2009). School travel modes: Factors influencing parental choice in four Brisbane schools. *Urban Policy and Research*, 27(1), 43–57. <https://doi.org/10.1080/08111140802304793>
- Rissotto, A., & Tonucci, F. (2002). Freedom of movement and environmental knowledge in elementary school children. *Journal of Environmental Psychology*, 22(1/2), 65–77. <https://doi.org/10.1006/jevp.2002.0243>
- Rothman, L., Macpherson, A. K., Ross, T., & Buliung, R. N. (2018). The decline in active school transportation (AST): A systematic review of the factors related to AST and changes in school transport over time in North America. *Preventive Medicine*, 111, 314–322. <https://doi.org/10.1016/j.ypmed.2017.11.018>
- Schoeppe, S., Tranter, P., Duncan, M. J., Curtis, C., Carver, A., & Malone, K. (2016). Australian children's independent mobility levels: Secondary analyses of cross-sectional data between 1991 and 2012. *Children's Geographies*, 14(4), 408–421. <https://doi.org/10.1080/14733285.2015.1082083>
- Sethi, D., Racioppi, F., & Bertollini, R. (2007). Preventing the leading cause of death in young people in Europe. *Journal of Epidemiology & Community Health*, 61(10), 842–843. <https://doi.org/10.1136/jech.2007.063081>
- Shaw, B., Bicket, M., Elliott, B., Fagan-Watson, B., Mocca, E., & Hillman, M. (2015). *Children's independent mobility: An international comparison and recommendations for action*. Policy Studies Institute.
- Shaw, B., Fagan-Watson, B., Frauendienst, B., Redecker, A., Jones, T., & Hillman, M. (2013). *Children's independent mobility: A comparative study in England and Germany (1971–2010)*. Policy Studies Institute. <https://westminsterresearch.westminster.ac.uk/item/8z178/children-s-independent-mobility-a-comparative-study-in-england-and-germany-1971-2010>
- Stark, J., Frühwirth, J., & Aschauer, F. (2018). Exploring independent and active mobility in primary school children in Vienna. *Journal of Transport Geography*, 68, 31–41. <https://doi.org/10.1016/j.jtrangeo.2018.02.007>
- Statham, J., & Chase, E. (2010). *Childhood wellbeing: A brief overview*. Childhood Wellbeing Research Centre.
- Swain, R., Oswin, P., Truelove, V., & Larue, G. S. (2024). Children's and parents' perceptions on safe routes to schools: A mixed-methods study investigating factors influencing active school travel. *Journal of Urban Design*, 29(2), 208–230. <https://doi.org/10.1080/13574809.2023.2223517>
- Tampaki, Z., Panagopoulos, T., Karanikola, P., Tampakis, S., & Ralousi, S. (2023). Active mobility versus motorized transport of high school students in Orestiada municipality of Greece. In E. G. Nathanail, N. Gavanis, & G. Adamos (Eds.), *Smart energy for smart transport: Proceedings of the 6th Conference on Sustainable Urban Mobility, CSUM2022, August 31–September 2, 2022, Skiathos Island, Greece* (pp. 847–857). Springer. https://doi.org/10.1007/978-3-031-23721-8_71
- UN-Habitat. (1996). *The habitat agenda: Goals and principles, commitments and the global plan of action*. <https://digitallibrary.un.org/record/213694?v=pdf#files>
- UNICEF. (2020). *Worlds of influence: Understanding what shapes child well-being in rich countries*.
- United States Department of Transportation. (2004). *Safe routes to school: Practice and promise*. <https://www.nhtsa.gov/sites/nhtsa.gov/files/saferoute2schlo.pdf>
- Wangzom, D., White, M., & Paay, J. (2023). Perceived safety influencing active travel to school—A built environment perspective. *International Journal of Environmental Research and Public Health*, 20(2), Article 1026. <https://doi.org/10.3390/ijerph20021026>
- Waygood, E. O. D., Friman, M., Olsson, L. E., & Taniguchi, A. (2017). Transport and child well-being: An integrative review. *Travel Behaviour and Society*, 9, 32–49. <https://doi.org/10.1016/j.tbs.2017.04.005>
- Weir, H. (2023). Children's autonomous mobility and their well-being. *Wellbeing, Space and Society*, 4, Article 100134. <https://doi.org/10.1016/j.wss.2023.100134>
- Westman, J., Johansson, M., Olsson, L. E., Mårtensson, F., & Friman, M. (2013). Children's affective experience

of every-day travel. *Journal of Transport Geography*, 29, 95–102. <https://doi.org/10.1016/j.jtrangeo.2013.01.003>

Wilson, K., Clark, A. F., & Gilliland, J. A. (2018). Understanding child and parent perceptions of barriers influencing children's active school travel. *BMC Public Health*, 18(1), Article 1053. <https://doi.org/10.1186/s12889-018-5874-y>

Wu, L., Wang, W., Jing, P., Chen, Y., Zhan, F., Shi, Y., & Li, T. (2020). Travel mode choice and their impacts on environment—A literature review based on bibliometric and content analysis, 2000–2018. *Journal of Cleaner Production*, 249, Article 119391. <https://doi.org/10.1016/j.jclepro.2019.119391>

Zuniga, K. D. (2012). From barrier elimination to barrier negotiation: A qualitative study of parents' attitudes about active travel for elementary school trips. *Transport Policy*, 20, 75–81. <https://doi.org/10.1016/j.tranpol.2011.12.003>

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