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Research Paper

What Shapes Parental Concerns? Exploring the Impact of the COVID-19 Pandemic on School Travel Behavior of Elementary School Students (Case Study: Rural Roads of Gilan Province)

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Abstract

This study examines the travel behavior of elementary school children in rural and suburban areas, focusing on the influence of parental concerns regarding traffic safety, the social environment, and the COVID-19 pandemic. Data were collected through surveys completed by 582 families with children attending elementary schools located near highways in Gilan Province, Iran. Using structural equation modeling (SEM), the study analyzes how these factors influenced travel mode choices both before and after the pandemic. The findings reveal that heightened concerns about traffic safety and social security significantly shaped travel decisions. Key results indicate that parental concerns about traffic safety, such as the availability of safe road crossings and adequate sidewalks, are primary determinants of travel mode selection, often resulting in increased reliance on private vehicles. Additionally, the COVID-19 outbreak exacerbated these concerns, introducing fears of virus transmission that drastically reduced public transportation usage while promoting private vehicle reliance and remote learning. The study also demonstrates that parents' perceptions of children's travel skills significantly impact travel choices, with safety concerns playing a crucial role. Policy recommendations include strengthening safety infrastructure, implementing traffic-calming measures, and enhancing community engagement to address social safety concerns. This research provides valuable insights into the factors influencing children's travel behavior in rural and suburban contexts, offering a foundation for targeted interventions.

Keywords: School travel behavior, Traffic safety, COVID-19, Rural travel, Structural Equation Modeling

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1. Introduction

Children's journeys to school in suburban and rural areas pose unique challenges that differ significantly from those encountered in urban environments. These challenges are often exacerbated by limited access to safe and reliable transportation options, underdeveloped infrastructure, and socio-economic disparities between urban and rural households [Fries et al., 2012]. In rural regions, children frequently travel longer distances on poorly developed roads, increasing their exposure to traffic hazards and environmental risks [Liu et al., 2020].

A key aspect under investigation is parental attitudes toward the travel modes chosen for their children's school commutes. These choices are strongly influenced by parents' perceptions of convenience, safety, and the health benefits associated with various travel modes. Environmental and traffic safety concerns have consistently been significant determinants of travel behavior. Fear of accidents often discourages parents from allowing their children to walk or cycle to school [Abulhassan & Davis, 2021; Morrison et al., 2019]. Additionally, social concerns, such as fears of bullying, child abduction, or interactions with strangers during the school journey, further influence parental decisions [Crawford et al., 2017; Oluyomi et al., 2014; Sweeney & Von Hagen, 2016]. Children's travel skills, including their ability to navigate traffic safely and manage social interactions, also play a crucial role in travel decisions. The development of these skills often determines whether children are permitted to travel independently without adult supervision [Nevelsteen et al., 2012; Waygood et al., 2021]. Finally, the COVID-19 pandemic in recent years has introduced additional complexities to children's travel behavior. This global health crisis presented parents with decisions influenced by public health guidelines, concerns over virus transmission, and shifting governmental policies. These concerns often led to a preference for travel modes that minimize contact with others, such as private vehicles [Abdullah et al., 2021; Zhang et al., 2022].

While extensive research over the past decade has examined children's travel behavior in urban areas, the travel behavior of children in rural and suburban regions has been largely overlooked. Travel patterns and decision-making processes of parents and children in these areas are often more complex due to factors such as limited access to transportation options, socio-economic disparities between urban and rural households, and the unique challenges posed by underdeveloped rural road infrastructure [Gilbert et al., 2023; Mitra & Manaugh, 2020].

To address this gap, the present study focuses on analyzing the travel behavior of elementary school students in rural areas of Gilan Province, both before and during the COVID-19 pandemic. Utilizing structural equation modeling (SEM), this research explores the intricate interactions between factors influencing travel decisions of parents and children prior to and following the pandemic. By shedding light on this under-researched aspect of children's mobility, the findings aim to inform policymakers and stakeholders in designing targeted interventions that enhance safety, accessibility, and sustainability of children's travel in rural and suburban settings.

2. Literature Review

Children's travel behavior, particularly the choice of travel modes selected by parents for school commutes, is influenced by a complex interplay of factors. These include parental attitudes, environmental and traffic safety concerns, social and security issues, children's safety and social skills, and more recently, the impact of the COVID-19 pandemic [Sims & Bopp, 2020]. Understanding these influences is essential for developing targeted interventions aimed at improving the safety and efficiency of

school travel, especially in suburban and rural areas where challenges such as long distances, limited infrastructure, and heightened traffic risks are common.

Socio-economic factors play a significant role in shaping elementary school children's travel behavior. Variables such as household income, parental education level, family structure, and neighborhood characteristics are critical determinants of children's travel mode choices. For instance, families with higher incomes are more likely to rely on private vehicles for school commutes, while low-income families tend to depend on public transportation or active travel modes such as walking and cycling [Gilbert et al., 2023; Mitra & Manaugh, 2020]. Children from families with lower socio-economic status often face barriers such as limited access to safe walking routes and inadequate public transportation [Gavin & Pedroso, 2010; Ravensbergen et al., 2016]. Moreover, parents with higher educational attainment are more likely to encourage active travel for their children due to their greater awareness of its health benefits [Muñoz-Galiano et al., 2020].

The COVID-19 pandemic further intensified and, in some cases, altered these patterns. Financially constrained families were disproportionately affected, as economic instability and restricted access to public transportation during the pandemic limited their travel options [Kurt & Izgi, 2023; Xi et al., 2023]. Families with parents working irregular hours also faced greater difficulties in coordinating their children's school commutes [Tsai, 2022]. Parental attitudes significantly impact children's travel behavior. Perceptions of safety, convenience, and health benefits associated with different travel modes are key determinants of parents' decisions [Carver et al., 2013; Mitra & Buliung, 2015; Rothman et al., 2018]. Lorenc et al. (2008) found that safety concerns often lead parents to favor private vehicles over walking or cycling. Similarly, Westman et al. (2017) reported that the distance between home and school had minimal impact on parental preferences for private vehicle use when accompanying their children. In suburban and rural areas, motorized transport is often prioritized due to longer distances and inadequate infrastructure for walking or cycling [Lorenc et al., 2008; Nevelsteen et al., 2012; Ridgewell et al., 2009].

Social perceptions also play a significant role in shaping parental attitudes. Nevelsteen et al. (2012) found that social security concerns and children's safety influenced travel mode choices. Abulhassan and Davis (2021) highlighted that parents' fear of road safety risks often discouraged walking or cycling, particularly in areas with high traffic volumes. Additionally, parents' own experiences shaped their attitudes. For instance, Chaufan et al. (2012) and Driller & Handy (2013) noted that parents who enjoyed walking or cycling in their childhood were more likely to encourage these activities for their children, although safety concerns frequently outweighed such preferences.

Traffic safety plays a crucial role in determining children's travel modes. This issue is particularly pronounced in suburban and rural areas, where traffic regulations may be less stringent, and the likelihood of encountering heavy vehicles is higher [Oluyomi et al., 2014]. Larouche et al. (2014) emphasized that fear of road accidents significantly influences parental decisions, especially in high-traffic areas with inadequate or unsafe infrastructure. Kim and Lee (2020) and Lorenc et al. (2008) demonstrated that well-designed walking and cycling paths can encourage active travel by alleviating parental safety concerns. Conversely, poorly maintained roads and the absence of safety measures increase reliance on motorized transportation. Traffic concerns are especially severe in suburban and rural regions, where high-speed traffic and poorly lit roads heighten the risk of accidents. Amiour et al. (2022) and Figueiredo Júnior et al. (2012) reported that children commuting in high-traffic

areas face a greater likelihood of road traffic accidents.

Social dynamics and concerns for children's safety add another layer of complexity to travel behavior. While social interactions during school commutes can enhance children's skills and independence, parents often restrict unsupervised travel due to safety concerns. Fears of bullying, abduction, or other forms of violence heavily influence parental decisions, particularly in less supervised suburban and rural areas [Sweeney & Von Hagen, 2016]. Carver et al. (2012) found that concerns over social safety, such as fear of encounters with strangers or potential harassment, often lead parents to escort their children to school. Group travel by children can mitigate some of these fears, as parents perceive it as safer [Garrard, 2021]. However, the dispersed nature of rural communities limits opportunities for group travel, thereby affecting travel mode choices. Fyhri and Hjorthol (2009) examined children's independent mobility in Norway, noting that while rural children generally had greater spatial freedom, concerns about social safety on isolated routes often resulted in parental accompaniment or reliance on motorized transport for school commutes.

Children's traffic and social safety skills are essential for enabling independent travel. Research by Mammen et al. (2012) highlights the importance of teaching children road safety and social interaction skills, which can enhance parental trust and willingness to permit independent travel. Garrard (2021) stressed that children with higher traffic safety knowledge are more likely to participate in active travel, as these skills alleviate parental concerns. However, the development of these skills varies, particularly in suburban and rural areas where children have fewer opportunities to practice them. In such areas, the lack of safe routes leads to reduced independent travel, diminishing parents' confidence in their children's commuting abilities [Carver et al., 2012; Mehdizadeh et al., 2017].

Perceived traffic safety skills positively influence the likelihood of active and independent travel, underscoring the need for traffic safety education. Jahani et al. (2020) recommended integrating comprehensive traffic safety programs into school curricula, particularly in rural areas, to bridge skill gaps and reduce dependency on motorized transportation. These measures could foster safer and more independent travel behaviors among children.

In recent years, the COVID-19 pandemic has introduced new challenges to school travel behavior. Studies by Musau et al. (2024) in the United States and Zhang et al. (2022) in China revealed that concerns about virus transmission on school buses have led to increased reliance on private vehicles. The pandemic also shifted parental preferences toward private transportation, perceived as a safer option that minimizes contact with others. Similarly, Abdullah et al. (2020) and De Vos (2020) highlighted that concerns over social distancing and exposure to the virus significantly altered travel behavior, prompting some families to avoid public transport while others turned to remote communication and online shopping [Shamshiripour et al., 2020].

The pandemic has also impacted transportation infrastructure and travel policies. Reduced public transportation services in suburban areas have made them less practical for school commutes, leading to a greater shift toward private transportation. Mitra et al. (2020) noted that heightened awareness of health risks might result in lasting changes in parental attitudes and travel behavior, with a preference for private over public or active transportation modes.

Despite substantial research in this field, several critical gaps remain. First, while numerous studies have investigated these factors in urban contexts, research focusing specifically on suburban and rural roads is limited. Second, the interactions between these factors in rural and suburban settings are not well understood.

Third, the long-term impacts of COVID-19 on school travel behavior in these regions remain unclear.

A review of existing studies also shows that most of this research has been conducted in American and European contexts. There is a pressing need to examine this topic in the Middle East, particularly in Iran, a developing country with high rates of road traffic accidents. This study emphasizes the importance of adopting a comprehensive approach to understanding and addressing school travel behavior in rural and suburban areas. Additionally, the present research aims to compare changes in children's travel modes and accompaniment patterns before the pandemic and after school reopenings. By accounting for the interplay of parental attitudes, safety concerns, children's skills, and emerging factors such as pandemic-related considerations, researchers and policymakers can develop more effective strategies to promote safe, healthy, and sustainable school travel in suburban and rural environments. Figure 1 illustrates the factors influencing families' choice of travel modes, as derived from the literature review.

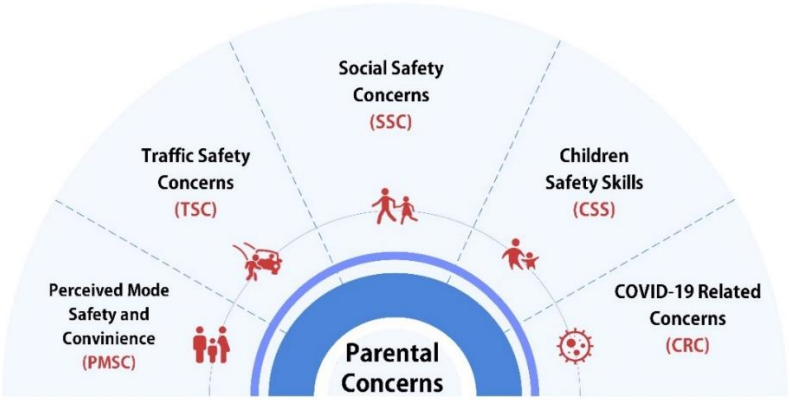

Figure 1. Effective variables on parents' concerns

3. Methodology

3.1. Study Area and Data Collection

As a case study, this research was conducted in the intercity roads of Gilan Province, located in northern Iran. The road infrastructure and school distribution in this province closely resemble the conditions in other provinces across the country. Gilan Province has a population of approximately 2.5 million, with 36% residing in rural areas due to its distinct climatic and geographic characteristics. The elementary schools situated along the intercity roads of Gilan include 273 schools, of which 68 are located along the province's highways, 116 alongside secondary roads, and 89 adjacent to rural roads (Figure 2).

A multi-stage process was implemented to design and administer a comprehensive questionnaire to investigate factors related to children's travel safety and parental attitudes toward travel modes. Initially, through a thorough review of relevant academic literature, key concepts and core research themes were identified, leading to the development of an initial set of 100 questions across five categories: 1) Perceptions of safety and convenience of travel modes (PMSC), 2) Traffic safety concerns (TSC), 3) Social safety concerns (SSC), 4) Children's safety skills (CSS), and 5) Pandemic-related concerns (CRC).

These questions were designed to comprehensively address both theoretical and practical aspects of the study. To ensure content validity, the initial questionnaire was reviewed by experts and refined using the Content Validity Index (CVI), resulting in a reduced set

of 121 questions. A pilot study was conducted with 50 parents of elementary school students in Gilan Province. Exploratory factor analysis (EFA) was employed, and items with factor loadings below 0.4 were excluded, leading to a final questionnaire containing 107 questions. Cronbach's alpha coefficient, exceeding 0.87, confirmed the reliability of the questionnaire.

Data for this study were collected through random cluster sampling across elementary schools located near Gilan's intercity roads. Parents of elementary school children completed the questionnaire within a week. Although the data collection process was interrupted by the COVID-19 pandemic, it resumed after schools reopened. Educational sessions were conducted in collaboration with the provincial traffic police and the Road Maintenance and Transportation Department to facilitate the redistribution of questionnaires. Post-pandemic, additional questions addressing health concerns and the risk of children contracting the virus were incorporated. Ultimately, after data cleaning, 582 valid questionnaires were selected for statistical analysis.

3.2. Structural Equation Modeling

The structural equation model (SEM) is a comprehensive and flexible analytical framework that identifies potential causal relationships among latent variables, as well as between latent and observed variables, while accounting for their mutual interactions [Kline, 2023]. SEM is particularly suitable for analyzing hypotheses where both observed and latent variables are present within the theoretical model. As one of the primary methods for analyzing complex and multivariate data structures, SEM simultaneously evaluates multiple independent and dependent variables [Kline, 2023]. It integrates various statistical techniques, such as factor analysis, regression, and path analysis, to model relationships between independent and dependent variables (structural model) and between latent and observed variables (measurement model).

In this study, the structural model was developed based on a conceptual framework derived from previous literature. The model is designed to test hypotheses regarding the influence of all identified factors on children's travel modes. Confirmatory factor analysis (CFA) assumes that empirical data can be described using a predefined set of parameters.

Figure 2. Scattered elementary schools along roadsides in Gilan Province

The model is informed by prior knowledge about the structure of the data and is built upon the following key hypotheses:

- **H1:** Prior to the COVID-19 pandemic, to what extent did parental attitudes toward different travel modes, concerns about traffic safety, concerns about social safety, and children's traffic and social skills interact with one another?
- **H2:** After the onset of the COVID-19 pandemic, to what extent did parental attitudes toward different travel modes, concerns about traffic safety, concerns about social safety, children's traffic and social skills, and parental concerns regarding children contracting COVID-19 interact with one another?

These hypotheses aim to provide a detailed understanding of the factors influencing children's travel behavior both before and during the pandemic, offering insights into the dynamic interplay between parental attitudes, safety concerns, and external disruptions such as COVID-19.

A total of 582 responses were selected for the final SEM modeling. Before conducting factor analysis, the suitability of the sample size and data for this analysis was assessed. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were employed for this purpose. The KMO value for the model was calculated as 0.907, and the chi-square statistic for Bartlett's test was 853.305 with a significance level of 0.001. Based on these results, the sample size and data were deemed appropriate for factor analysis, and the outcomes were considered reliable [Delavar, 2004]. Table (1) shows the goodness-of-fit indices for the two models before and after the Corona pandemic, which indicates the appropriate fit of both models. In addition, Table (2) shows that Cronbach's alpha, composite reliability (CR) and average variance extracted (AVE) are all within the desired range. Therefore, it can be said that the reliability and convergent validity status of the external relations of the research model is appropriate.

4. Results and Discussion

4.1. Goodness of Fit Results

Table 1. Goodness of fit indicators of models

Measure	Acceptance range	Model measurement		Validity	
		Before	After	Before	After
Goodness-of-fit (GFI)	> 0.90	0.921	0.925	OK	OK
Adjusted goodness-of-fit (AGFI)	> 0.85	0.901	0.906	OK	OK
Tucker Lewis Index (TLI)	> 0.90	0.903	0.902	OK	OK
Comparative Fit Index (CFI)	> 0.90	0.930	0.925	OK	OK
Root Mean Square Residual (RMR)	< 0.08	0.056	0.042	OK	OK
Root-mean-square error of approximation (RMSEA)	< 0.06	0.049	0.037	OK	OK
Normed Chi-square (CMIN/DF)	> 5.0	3.869	3.872	OK	OK

Table 2. Results of Cronbach's alpha, reliability and convergent validity criteria (before and after the pandemic)

Variable	No. of items		Cronbach's Alpha (>0.70)		CR (>0.70)		AVE (>0.50)	
	Before	After	Before	After	Before	After	Before	After
PMSC	3	-	0.933	-	0.944	-	0.849	-
TSC	9	8	0.879	0.905	0.900	0.899	0.508	0.501
SSC	9	10	0.913	0.853	0.925	0.915	0.536	0.506

Variable	No. of items		Cronbach's Alpha (>0.70)		CR (>0.70)		AVE (>0.50)	
	Before	After	Before	After	Before	After	Before	After
CSS	6	4	0.843	0.815	0.851	0.798	0.501	0.503
CRC	-	4	-	0.880	-	0.870	-	0.632

4.2. Pre-Pandemic Period

The analysis of school travel behavior before the COVID-19 pandemic, conducted through SEM, revealed significant relationships between latent variables and school travel modes, as well as between observed variables and their corresponding latent variables (Figure 3).

4.2.1. Influence of Observed Variables on Latent Variables

- **Traffic Safety Concerns (TSC):** The results indicate that observed variables have a significant impact on parents' traffic safety concerns. Specifically, the presence of safe sidewalks near homes (β= 0.756) and in residential areas (β= 0.765) plays a crucial role in reducing parental anxieties. This finding aligns with studies like Rothman et al. (2021), which demonstrate that dedicated and secure walkways increase parents' confidence in active travel modes like walking to school, thereby reducing reliance on private vehicles. Furthermore, the positive influence of cautious driving by motorists near children (β= 0.768) on parents' safety perceptions is prominent. This result is consistent with the findings of Kim and Lee (2020) and Morrongiello and Barton (2009), who showed that responsible driver behavior and traffic control measures such as speed bumps and speed reduction near schools contribute to lowering perceived risks and encourage parents to choose more active modes of transportation. On the other hand, children crossing streets or highways (β= -0.716) is a factor that increases parental concerns. This issue reflects common challenges in suburban and rural areas, where inadequate pedestrian infrastructure exacerbates safety anxieties. Similarly, Benoit et al. (2022) have shown that in these regions, the lack of suitable infrastructure for pedestrians and cyclists drives parents towards using motorized modes, as these options are perceived as safer. These results clearly demonstrate the importance of investing in appropriate pedestrian infrastructure. In particular, safe street crossings through overpasses, underpasses, or equipped traffic lights can help alleviate these concerns.
- **Social Safety Concerns (SSC):** Parents' concerns about social safety are strongly influenced by perceived threats and environmental risks. The present findings indicate that environmental factors such as harassment by strangers (β= -0.694) and children passing through dark paths (β= -0.803) play a key role in increasing parents' social concerns. These factors are consistent with the research by Johansson (2003), which shows that parents in England and Sweden are concerned about strangers, crime, and drugs, leading to protective behaviors such as driving children [Johansson 2003]. For example, they have shown that environments with adequate lighting and increased social surveillance can directly reduce the level of these perceived threats. Also, the role of social cohesion in reducing parental concerns has been particularly highlighted. The findings related to the positive effect of familiarity with neighbors (β= 0.416) suggest that social interactions among residents of the neighborhood, especially in communities with more cohesive social structures, can create a greater sense of security among parents. These findings are in line with the results of Mitra et al. (2014), who have shown that social cohesion and neighborhood interactions play a key role in creating safer environments for children to play. In addition, the research by Villanueva et al. (2013) has

emphasized that strengthening social relationships among neighborhood residents not only helps to reduce social concerns but also increases the possibility of children's independent travel. From an environmental design perspective, numerous studies have examined the importance of redesigning streets and creating green spaces to reduce perceived threats. For example, research by Kim and Lee (2020) has shown that the presence of natural elements such as trees and the design of pedestrian paths with better visibility can enhance parents' sense of security and reduce concerns related to children's travel. Furthermore, Wolfe and McDonald (2016) have emphasized the importance of social and environmental characteristics, such as crime reduction and increased social cohesion, in creating more suitable spaces for children's travel.

- **Children's Safety Skills (CSS):** Children's safety skills (CSS) are a key factor in reducing the risks of their independent travel and are directly related to awareness and responsible behavior indicators. The present results show that children's ability to understand and comply with traffic signs (β= 0.757) and accuracy when crossing streets (β= 0.869) are important factors that contribute to improving children's safety. These findings are consistent with the results and suggestions of research by Schwebel, Davis, and O'Neal (2012) and Sweeney and Von Hagen (2016), which have emphasized the importance of traffic education in schools and families to promote these skills. They state that continuous and practical training of children in real traffic environments can be very effective in strengthening their ability to identify hazards and make safe decisions. In contrast, negative behaviors such as carelessness when crossing streets (β= -0.567) and running when entering or leaving school (β= -0.465) can significantly reduce children's perceived safety. These behaviors not only increase the risk of accidents but also fuel parents' concerns about children's independent travel. Similar results have been reported in a study by Wilson, Clark, and Gilliland (2018), which shows that such high-risk behaviors, especially in high-traffic areas, require targeted interventions and specialized training. In addition, a study by Ikeda et al. (2019) has emphasized that educational programs designed should include practical activities and real scenarios so that children can strengthen their skills in various situations. This research has also shown that rural areas, due to the lack of adequate infrastructure and high environmental risks, require special attention. Designing safer routes and creating low-speed zones near schools are among the key suggestions for improving safety in these areas. Based on these findings, it can be concluded that coherent educational programs that promote positive behaviors and correct negative behaviors, especially in high-risk environments, are essential to improve children's safety. Also, cooperation between schools, families, and local institutions can play an important role in improving infrastructure and strengthening children's safety skills. These measures can lead to a reduction in risky behaviors and increase children's awareness of the importance of safe behaviors.
- **Perception of Travel Mode Safety and Comfort (PMSC):** Perception of travel mode safety and comfort (PMSC) strongly influences parents' choice of transportation modes for children's trips. The results show that walking (PMSC_WA, β= -0.864) is negatively perceived, especially due to parents' perception of low safety and lack of suitable pedestrian infrastructure. This finding is consistent with research by Mehdizadeh et al. (2017), which shows that parents in many countries prefer walking and cycling less for their children due to safety concerns. They have emphasized that the lack of safe crossings and the absence of dedicated

pedestrian paths can reinforce this negative perception. In contrast, traveling by private vehicles (PMSC_PV, β= 0.841) is widely perceived as the safest and most comfortable option by parents. This indicates widespread dependence on private cars, which are often preferred due to safety concerns, comfort, and ease of access in rural environments. In addition, the findings show that the health benefits associated with cycling or walking (β= -0.756) are less valued. This may be due to parents' low awareness of the benefits of active transportation or preferring short-term comfort over long-term health benefits. Research by Faulkner et al. (2009) and Larouche et al. (2014) has shown that the lack of educational programs focused on the benefits of active transportation for children and parents can lead to neglecting these benefits. They also emphasize the importance of combining educational interventions with infrastructure improvements. These findings suggest that changing parents' perception of the safety and comfort of transportation modes can play a fundamental role in encouraging the use of active transportation. Designing safer routes, creating awareness campaigns about the health benefits of active transportation, and increasing access to appropriate infrastructure for walking and cycling are among the measures that can facilitate this change.

4.2.2. Interactions Between Latent Variables

The relationships between latent variables in the pre-pandemic model provide important insights into how parents' concerns and perceptions influence children's travel decisions and independence. A significant positive relationship (β= 0.671) was observed between TSC and PMSC, suggesting that increased traffic safety concerns lead parents to prefer transportation modes that are perceived as safer and more comfortable, particularly the use of private vehicles. This finding reinforces the role of safety attitudes in travel mode choice [Guliani et al. 2015, Kim and Lee 2020, Oluyomi et al. 2014].

The strong negative relationship (β= -0.862) between SSC and CSS also highlights how parents' fear of social threats, such as harassment or harm, reduces their confidence in a child's ability to travel independently. This finding is consistent with the results of Bennetts et al. (2018) and Crawford et al. (2017), which suggest that parents' protective behavior, often driven by perceived risks, limits children's opportunities to develop essential safety skills and independence.

Furthermore, a moderate positive relationship (β= 0.589) between SSC and PMSC indicates that parents who are more concerned about social safety are more likely to view private modes of travel as safer and more appropriate. This dynamic reinforces the role of environmental risks in shaping travel mode preferences, as parents seek travel methods that minimize exposure to perceived social threats. These relationships generally point to the interplay between safety concerns and travel mode preferences, and emphasize the need for interventions that reduce both environmental risks and parental anxiety while providing opportunities for children's skill development and independence.

In summary, the pre-pandemic results emphasize the importance of infrastructure and the perception of travel mode safety and comfort in shaping parents' concerns and travel choices. Traffic safety concerns are strongly influenced by the presence or absence of safe pedestrian infrastructure. These findings demonstrate the importance of investing in pedestrian crossings, sidewalks, and traffic calming measures to reduce parental anxiety and promote active transportation. Similarly, addressing social safety concerns requires a two-pronged approach: improving the physical security of travel environments and strengthening social networks to promote trust and neighborhood cohesion.

The strong preference for private vehicles in the perception of travel mode safety and comfort construct reflects a broader trend of reliance on private transportation due to perceived safety, comfort, and time efficiency. However, the undervaluation of active transportation modes such as walking or cycling represents a missed opportunity to promote healthier and more sustainable travel behaviors. Public awareness campaigns that emphasize the health and environmental benefits of active travel, along with infrastructure improvements to enhance the safety of pedestrians and cyclists, can help shift parents' perceptions.

The relationships between latent variables show that heightened concerns, whether related to traffic or social issues, drive preferences for private modes of travel and further limit children's opportunities to develop independence. This highlights the need for interventions that balance parents' safety concerns with efforts to encourage children's independence. Traffic education programs, safer routes to school, and community-based initiatives can bridge this gap and create environments where active and independent travel is both safe and encouraged.

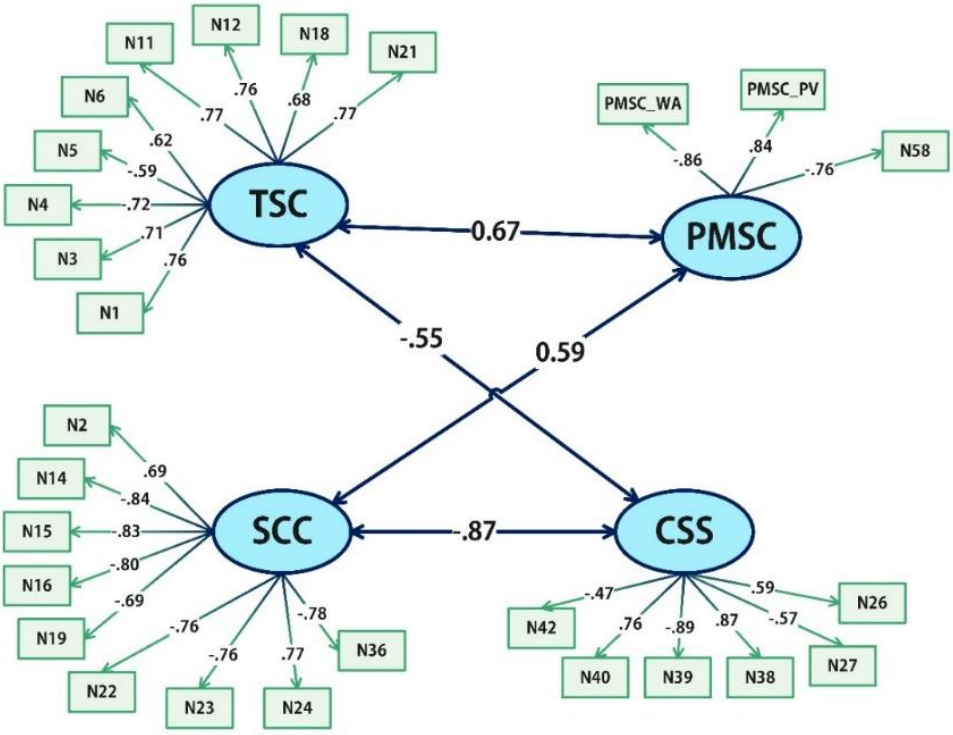

Figure 3. Pre-pandemic SEM model of parents' concerns

4.3. Post-Pandemic Period

Based on the SEM results for the post-pandemic period, the increasing or decreasing impacts of observed variables on latent variables remained similar to those in the pre-pandemic period, but the magnitude of these impacts differed (Figure 4).

4.3.1. Influence of Observed Variables on Latent Variables

- **Traffic Safety Concerns (TSC):** Traffic safety concerns (TSC) continue to be significantly influenced by infrastructural variables in the post-pandemic period. The findings indicate that the presence of safe sidewalks near homes (β= 0.776) and schools (β= 0.756) plays a crucial role in reducing parental concerns. Proper environmental design, such as creating safe pedestrian lanes and using high-quality materials in roads, can increase the level of perceived safety. In addition, traffic safety measures such as clear road markings (β= 0.612) and cautious driver

behavior around children (β= 0.742) have been highlighted as positive factors in reducing parental concerns. These findings show that responsible driver behavior and local measures to reduce speed reduce concerns related to children's safety. Risk-increasing factors, especially the requirement for children to cross streets (β = -0.767) or attend schools near a highway (β = 0.175), intensified parental anxiety. Such findings underscore the persistent difficulty of providing safe travel environments in suburban and rural areas with limited infrastructure. Research by Kim and Lee (2020) has also shown that highways and high-speed roads not only reduce parents' perception of safety but also limit children's movement independence.

- **Social Safety Concerns (SSC):** Social safety concerns remain one of the most important factors affecting parents' decisions about children's travel. The findings indicate that perceived external risks, harassment (β = -0.665) and children walking along poorly lit or otherwise unsafe routes (β = -0.814; -0.820), have heightened parents' worries. These findings are consistent with the results of research by Crawford et al. (2015) and Lin et al. (2017). In contrast, parents' familiarity with neighbors (β= 0.375) has a positive effect on reducing social concerns. This finding is consistent with research by Booth and Shaw (2020), Mitra and Buliung (2012, 2014), which has shown that positive interactions and social cohesion in the neighborhood can increase the sense of security in parents and reduce anxieties related to children's safety. Strong social networks and effective local interactions can increase the level of trust and improve the likelihood of informal monitoring in the neighborhood environment.

These findings show that reducing parents' social safety concerns requires combined interventions that focus on improving the physical and social environment. Improving local infrastructure, such as street lighting, creating safe public spaces, and increasing social surveillance, can help reduce concerns related to social threats. In addition, community-based programs that strengthen social interactions among neighborhood residents, such as organizing local events or creating parent support groups, can help increase the sense of neighborhood cohesion. Communities with high social cohesion and strong local interactions not only lead to a greater sense of security for parents but also strengthen children's movement independence [Booth and Shaw 2020]. For areas with high levels of social concerns, a combination of physical and social measures is necessary. For example, increasing the presence of local police or creating smart surveillance systems can enhance the sense of security in high-risk environments. At the same time, educational programs for parents on managing social risks and raising awareness about the benefits of creating social networks can have long-term positive effects.

- **Children's Safety Skills (CSS):** Children's traffic-safety skills are reflected in how accurately and responsibly they behave on the road. The results showed that accurate behavior when crossing streets (β= -0.805) and observing traffic safety signs (β= -0.437) are positively associated with children's safety skills. These findings indicate the importance of traffic education in developing these skills. Structured educational programs can help children better identify environmental hazards and have safer reactions. Conversely, inattention and playful behaviour (β = 0.550) hindered the development of those skills. These behaviors may lead to a decrease in children's accuracy in identifying and managing risks, especially in complex traffic environments. A study by Dong et al. (2022) shows that careless behaviors in children can be caused by a lack of practical experience in dealing with real situations and a lack of sufficient awareness

of the dangerous consequences. Also, participatory programs that involve parents in the education process can increase parents' confidence in children's abilities and reduce unsafe behaviors [Muñoz-Galiano et al. 2020].

- **Concerns Related to COVID-19 (CRC):** The construct of concerns related to COVID-19 has had a profound impact on parents' attitudes and behaviors in the field of children's movement and education during the pandemic. The results show that parents' major concerns include the risks of contracting the virus (β= 0.985) and the impact of using masks on children's accuracy and attention (β= 0.822). These findings are consistent with a study by Chaabane et al. (2021), which showed that school closures and social distancing practices have led to significant changes in children's physical and mental health, including reduced physical activity and increased body mass index. In addition, observing health and social distancing practices (β= -0.670) has had a positive effect on reducing some of parents' concerns. A study by Kim et al. (2021) also emphasized that increased health concerns have led to dramatic changes in parents' travel behaviors, including preferring the use of private vehicles to reduce the risks of exposure to the virus. In this regard, parents' preference for online education (β= 0.429) has emerged as a mechanism to reduce health and social risks. Also, findings by Harmon and Arnold (2023) show that parents have been more inclined towards online education during the pandemic, but these changes have created concerns about reducing children's social interactions. These studies emphasize that parents need more accurate information and comprehensive support strategies to manage these conditions.

4.3.2. Interactions Between Latent Variables

Traffic safety concerns showed a strong negative correlation with children's safety skills (β= -0.980), suggesting that heightened concerns about traffic safety continue to reduce parents' confidence in their children's ability to travel independently. Traffic safety concerns, in particular, play an important role in parents' decisions about allowing children to travel independently [Nevelsteen et al. 2012]. Parents' physical activity levels and their perceptions of sidewalk and street safety are strong predictors of children's independent travel [Santos et al. 2013].

SSC also showed a significant negative relationship with children's safety skills (β= -0.974). Similar to the pre-pandemic data, social anxieties related to harassment and harm further reduced parents' confidence in children's ability to travel alone.

The weak positive correlation between COVID-19 related concerns and children's safety skills (β= 0.182) suggests that health practices and health-related awareness may have a positive, albeit small, impact on children's cautious behavior during the pandemic.

Interestingly, there is a weak correlation between COVID-19 related concerns and social safety concerns (β= 0.049), indicating limited overlap between health-related concerns and general social safety concerns, reflecting the unique nature of pandemic-induced fears.

Overall, the findings of the post-pandemic model highlight the profound impact of COVID-19 on parents' concerns and children's mobility. The dominance of health-related concerns, as observed in the impact of COVID-19 related concerns, reflects a fundamental shift in parents' priorities during the pandemic. This finding is consistent with recent studies that have pointed to the transformative effects of the pandemic on travel behavior and educational preferences [Alonzi et al. 2021, Anderson, Hughes, and Trivedi 2021, Colucci, Smith, and Browne 2023, Painter et al. 2024, Zafar et al. 2022].

To address these challenges, policymakers should prioritize interventions that address both health and safety concerns. Improving pedestrian and traffic infrastructure, such as creating safe crossing zones and separate walking paths, remains essential to reduce traffic safety concerns. Also, community-level initiatives to improve neighborhood safety and strengthen social cohesion can reduce social safety concerns and allow for more independent mobility for children.

Furthermore, integrating traffic safety education into school curricula can help bridge the skills gap in children's safety skills. Finally, incorporating pandemic-related considerations, such as promoting health practices and providing hybrid learning options, will be critical to adapting to the evolving needs of parents and children in the post-pandemic world. These strategies collectively contribute to a more resilient, inclusive, and child-friendly transportation system.

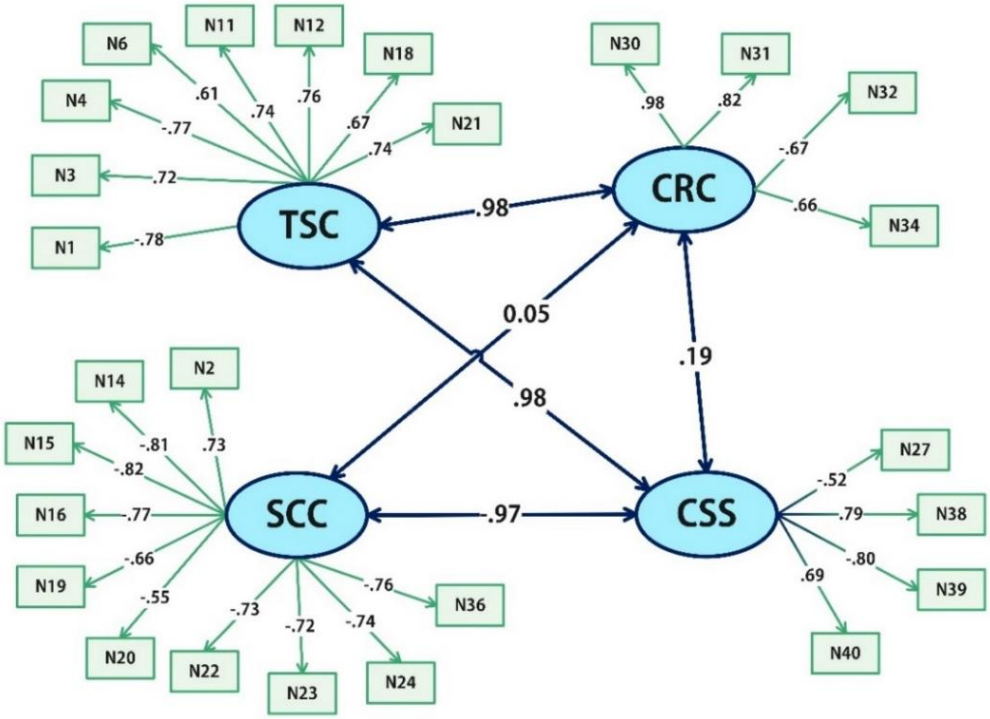

Figure 4. Post-pandemic SEM model of parents' concerns

4.4. Comparison of the Two Periods

A comparative analysis of the pre- and post-pandemic models reveals significant changes in the factors influencing parents' concerns, children's safety skills, and school travel behaviors. These changes highlight the profound impact of the pandemic on families' safety perceptions and travel choices.

Before COVID-19, parents' traffic-safety worries were driven mainly by infrastructure: the availability of safe sidewalks near homes and schools (β= 0.756; β= 0.761) and clear road markings (β= 0.613). The single biggest deterrent was the need for children to cross busy roads (β= -0.716). After the pandemic the same elements remained important (sidewalks: β = 0.776; 0.756), but having to cross a road became an even stronger concern (β = -0.767). The heightened sensitivity suggests that COVID-19 amplified parents' perception of environmental hazards during the school trip.

Before the pandemic, parents' social-safety worries centred on harassment (β = -0.694), poorly lit routes (β = -0.803) and lack of adult supervision (β = -0.803). Knowing nearby neighbours helped offset those fears (β = 0.416). The same issues persisted after COVID-19, but their influence grew (e.g., harassment: β

= -0.665; dark routes: β = -0.820), hinting that reduced social contact during lockdowns heightened anxieties about strangers. This suggests that the pandemic has exacerbated social safety anxieties, possibly due to reduced social interactions and increased concerns about encountering strangers during periods of physical distancing. These findings emphasize the need to rebuild community trust and neighborhood security in the post-pandemic period.

Prior to COVID-19, children's ability to cross streets safely (β = 0.869) and recognise traffic signs (β = 0.757) strongly boosted parents' confidence, whereas inattention undermined it (β = -0.567). Post-pandemic, these positive effects weakened (safe-crossing awareness: β = 0.784; traffic-sign recognition: β = -0.437), and mask-wearing further distracted children (β = -0.822). These changes indicate that the pandemic has created new barriers to skills development and highlights the need for targeted programs to rebuild lost competencies. The post-pandemic model introduced concerns related to COVID-19 as a new construct that reflects pandemic-specific anxieties. The risks of contracting the virus (β= 0.985) and behavioral effects related to observing hygiene (β= -0.670) dominated this construct. Also, parents' preference for virtual education (β= 0.429) emerged as a key factor. These findings highlight the profound impact of the pandemic on changing parents' priorities and behaviors.

Before the pandemic, significant negative correlations between traffic safety concerns and children's safety skills (β= -0.547) and between social safety concerns and children's safety skills (β= -0.862) showed that heightened concerns reduced parents' confidence in children's independence. These results confirm previous findings that overly protective parental behaviors, driven by safety fears, often limit opportunities for skills development. After the pandemic, these negative relationships intensified, including: (β= -0.980) and (β= -0.974). The introduction of COVID-19 related concerns showed a weak positive relationship with children's safety skills (β= 0.182), reflecting the minor positive impact of pandemic-era health practices on children's cautious behavior. However, the limited strength of this relationship suggests that health anxieties have created more new challenges than helping to improve skills.

A comparative analysis of the pre- and post-pandemic models reveals important changes in parents' concerns, children's safety skills, and travel behaviors. The pandemic exacerbated traffic and social safety concerns, as infrastructural factors such as crossing streets and the lack of adequate sidewalks, along with new fears related to COVID-19, increased parents' anxiety. To reduce these concerns, it is necessary to improve safe infrastructure, smart traffic monitoring, and financial incentives for using public transportation. At the same time, pandemic restrictions have reduced independent travel opportunities and reduced children's safety skills, which requires interactive training, simulated learning environments, and gradual parental involvement in increasing children's independence.

The introduction of COVID-19 related concerns shows a change in parents' mobility patterns and the profound impact of health fears on reducing the use of public transportation and increasing dependence on private vehicles. These findings highlight the need for measures such as improving public transport hygiene, public health education, and providing hybrid learning options. In addition, the findings point to the interaction between safety and access, which requires integrated transportation networks, rural access projects, and strengthening social cohesion to rebuild parents' trust and strengthen children's independence.

This comparison highlights the importance of long-term adaptability in transportation and safety planning. Transportation systems must be resilient to respond to traditional safety challenges and emerging risks such as

pandemics. Child-centered policy approaches that emphasize education, infrastructure development, and social interactions can provide safer, more accessible, and more suitable environments for children's development in normal and crisis conditions. These approaches, by integrating health and safety measures, offer comprehensive solutions to current and future challenges.

5. Conclusion

This study aimed to analyze the travel behavior of elementary school children in rural and suburban areas, with a particular focus on the influence of parental concerns about traffic safety, the social environment, and the COVID-19 pandemic. Using SEM, the research examined how these factors affected travel mode choices before and after the pandemic. By offering insights into the specific challenges faced by children in rural and suburban areas—where infrastructure and safety concerns are more pronounced compared to urban settings—this study contributes to the existing body of literature.

The findings revealed that parental concerns about traffic safety and the social environment were significant determinants of children's travel modes. Traffic-related concerns, particularly road-crossing safety and the adequacy of sidewalks, were influential in increasing parental reliance on private vehicles. During the pandemic, these concerns were exacerbated by fears of virus transmission, which reduced the use of public transportation and encouraged the adoption of private vehicles or virtual education alternatives. Additionally, the study found that parents' perceptions of their children's travel skills, particularly their ability to navigate traffic safely, significantly influenced travel decisions.

5.1. Policy Recommendations

Based on these findings, several policy recommendations can be made:

- Improving Traffic Safety Infrastructure: To address traffic-related concerns, enhancing safety infrastructure in rural and suburban areas is essential. These improvements should include the construction of safe pedestrian crossings, better road signage, and the provision of improved sidewalks and cycling paths. Furthermore, traffic-calming measures, such as reducing vehicle speeds near schools, should be implemented to enhance overall safety for children who walk or cycle to school.
- Addressing Social Safety Concerns: Policies aimed at reducing social environment concerns should focus on increasing law enforcement presence and community involvement around schools. Programs that promote community surveillance initiatives, along with increased police patrols, can help alleviate parental anxiety about potential threats to their children's safety. Educational campaigns to raise public awareness about traffic safety and social responsibility, particularly in school zones, can also contribute to creating a safer environment for children.

5.2. Future Research Directions

This study has several limitations that readers should keep in mind. All information on travel modes, parental concerns, and children's traffic-safety skills was obtained through a single, self-reported questionnaire, an approach that is susceptible to recall error and social-desirability bias and prevents causal inference. The research is also geographically specific: every respondent came from roadside elementary schools in Gilan Province, a coastal region whose tourist traffic and social fabric may differ from other rural settings and, even more, from dense urban areas. In addition, we focused only on pupils in grades 1–6; the mobility patterns of teenagers, who typically enjoy greater autonomy and use public transport more frequently, were not captured. Finally, the analysis rested on stated rather than revealed behaviour; without objective tracking data we could not verify the actual routes, distances, or hazards that children encountered.

These constraints open clear avenues for future work. Longitudinal designs that blend parental surveys with objective mobility records, such as smartphone GPS logs, wearable sensors, or participatory video audits, would help triangulate self-reports and show how parental concerns and children's travel choices co-evolve over time. Replicating the model in urban cores, peri-urban fringes, and multiple provinces across Iran and neighbouring Middle-Eastern countries would test whether the latent constructs hold under different infrastructure densities, cultural norms, and governance regimes. Deeper investigation of digitalisation is also warranted: remote-learning timetables, ride-sharing platforms, and virtual after-school activities may be reshaping daily mobility demand in ways yet to be measured. Lastly, before-and-after studies of interventions, traffic-calming schemes, Safe-Routes-to-School programmes, and community-building initiatives, should assess not only infrastructure effectiveness but also their influence on children's independent-mobility skills and neighbourhood social capital. Collectively, such studies would build a more transferable evidence base for policies that make school travel safer and more sustainable in both rural and urban contexts.

6. References

- Abdullah, M., Ali, N., Hussain, S. A., Aslam, A. B., & Javid, M. A. (2021). Measuring changes in travel behavior pattern due to COVID-19 in a developing country: A case study of Pakistan. Transport Policy, 108, 21-33. https://doi.org/10.1016/j.tranpol.2021.04.023

- Abdullah, M., Dias, C., Muley, D., & Shahin, M. (2020). Exploring the impacts of COVID-19 on travel behavior and mode preferences. Transportation Research Interdisciplinary Perspectives, 8, 100255. https://doi.org/10.1016/j.trip.2020.100255

- Abulhassan, Y., & Davis, G. A. (2021). Considerations for the transportation of school aged children amid the Coronavirus pandemic. Transportation Research Interdisciplinary Perspectives, 9, 100290. https://doi.org/10.1016/j.trip.2020.100290

- Amiour, Y., Waygood, E. O. D., & van den Berg, P. E. W. (2022). Objective and Perceived Traffic Safety for Children: A Systematic Literature Review of Traffic and Built Environment Characteristics Related to Safe Travel. International Journal of Environmental Research and Public Health, 19(5), 2641. https://doi.org/10.3390/ijerph19052641

- Ariyani, D. T., Aulia, I. F., Suryobuwono, A. A., & Marlita, D. (2020). SWITCH POTENTIAL OF THE USERS FROM USING PUBLIC TRANSPORTATION TO PRIVATE TRANSPORTATION AS AN IMPACT OF PANDEMIC COVID - 19 (CASE STUDY IN JABODETABEK 2020). Advances in Transportation and Logistics Research, 3(0), 143-151. https://doi.org/10.25292/atlr.v3i0.260

- Berg, J., & Ihlström, J. (2019). The Importance of Public Transport for Mobility and Everyday Activities among Rural Residents. Social Sciences, 8(2), 58. https://doi.org/10.3390/socsci8020058

- Brough, R., Freedman, M., & Phillips, D. C. (2021). Understanding socioeconomic disparities in travel behavior during the COVID-19 pandemic. Journal of Regional Science, 61(4), 753-774. https://doi.org/10.1111/jors.12527

- Carver, A., Timperio, A., & Crawford, D. (2013). Parental chauffeurs: what drives their transport choice? Journal of Transport Geography, 26, 72-77. https://doi.org/10.1016/j.jtrangeo.2012.08.017

- Carver, A., Timperio, A. F., & Crawford, D. A. (2012). Young and free? A study of independent mobility among urban and rural dwelling Australian children. Journal of Science and Medicine in Sport, 15(6), 505-510. https://doi.org/10.1016/j.jsams.2012.03.005

- Chaufan, C., Yeh, J., Ross, L., & Fox, P. (2012). Parental views on active commuting and choice of mode of school transport. Journal of Behavioral Health, 1(1), 35. https://doi.org/10.5455/jbh.20120322124110

- Chen, P., Jiao, J., Xu, M., Gao, X., & Bischak, C. (2018). Promoting active student travel: A longitudinal study. Journal of Transport Geography, 70, 265-274. https://doi.org/10.1016/j.jtrangeo.2018.06.015

- Coșarbă, E., Roman, A. F., & Costin, A. (2021). Parents' perception regarding the concerns, competencies and perspectives of involvement in non-formal activities. Technium Social Sciences Journal, 26, 177-185. https://doi.org/10.47577/tssj.v26i1.5115

- Crawford, S. B., Bennetts, S. K., Hackworth, N. J., Green, J., Graesser, H., Cooklin, A. R., Matthews, J., Strazdins, L., Zubrick, S. R., D'Esposito, F., & Nicholson, J. M. (2017). Worries, 'weirdos', neighborhoods and knowing people: a qualitative study with children and parents regarding children's independent mobility. Health & Place, 45, 131-139. https://doi.org/10.1016/j.healthplace.2017.03.005

- Das, S., Boruah, A., Banerjee, A., Raoniar, R., Nama, S., & Maurya, A. K. (2021). Impact of COVID-19: A radical modal shift from public to private transport mode. Transport Policy, 109, 1-11. https://doi.org/10.1016/j.tranpol.2021.05.005

- De Vos, J. (2020). The effect of COVID-19 and subsequent social distancing on travel behavior. Transportation Research Interdisciplinary Perspectives, 5, 100121. https://doi.org/10.1016/j.trip.2020.100121

- Delavar, A. (2004). Theoretical and Practical Foundations of Research in the Humanities and Social Sciences (3 ed.). Bud of Growth (in Persian).

- Driller, B. K., & Handy, S. (2013, 2013). Exploring the Influence of Parents on Children's Bicycling in Davis, California.

- Figueiredo Júnior, I., de Carvalho, M. V., & de Lima, G. M. (2012). Pediatric trauma due to motor vehicle accidents on high traffic roadway. Einstein (Sao Paulo, Brazil), 10(1), 29-32. https://doi.org/10.1590/s1679-45082012000100007

- Fries, R., Sykut, E., & Zhou, H. (2012). Barriers Influencing Illinois Children School Travel Mode Choices. Advances in transportation studies. https://www.semanticscholar.org/paper/Barriers-Influencing-Illinois-Children-School-Mode-Fries-Sykut/d8c50a64a26038d10f04ea8ff10e1e72667126ce

- Fyhri, A., & Hjorthol, R. (2009). Children's independent mobility to school, friends and leisure activities. Journal of Transport Geography, 17(5), 377-384. https://doi.org/10.1016/j.jtrangeo.2008.10.010

- Garrard, J. (2021). Women and Cycling: Addressing the Gender Gap. In (pp. 197-218).

- Gavin, K., & Pedroso, M. S. (2010, 2010/06/01/). Implementing Safe Routes to School in Low-Income Schools and

Communities: A Resource Guide for Volunteers and Professionals.

- Gilbert, H., Lanng, D. B., Wind, S., & Allan, A. (2023). Understanding the complexity of children's everyday mobilities: non-instrumental aspects in sustainable transport and planning policy making in Australia. Applied Mobilities, 8(4), 341-360. https://doi.org/10.1080/23800127.2022.2071060

- Jahani, A. A., Esmaeili, M., & Barani, M. (2010). The relationship between traffic rules education and traffic behaviors of Tehrani students. Rahoor Scientific Quarterly, 2010(32), 113-138. http://talar.jrl.police.ir/article_94120.html (in Persian).

- Kim, Y.-J., & Lee, C. (2020). Built and Natural Environmental Correlates of Parental Safety Concerns for Children's Active Travel to School. International Journal of Environmental Research and Public Health, 17(2), 517. https://doi.org/10.3390/ijerph17020517

- Kline, R. B. (2023). Principles and Practice of Structural Equation Modeling. Guilford Publications. https://books.google.com/books?id=t2CvEAAAQBAJ

- Kurt, I., & Izgi, F. D. (2023). Covid 19 Impact on Families. London Journal of Social Sciences(5), 33-42. https://doi.org/10.31039/ljss.2023.5.96

- Larouche, R., Saunders, T. J., Faulkner, G. E. J., Colley, R., & Tremblay, M. (2014). Associations Between Active School Transport and Physical Activity, Body Composition, and Cardiovascular Fitness: A Systematic Review of 68 Studies. https://doi.org/10.1123/jpah.2011-0345

- Liu, Y., Wang, M., Kang, L., He, C., Miao, L., Chen, L., Zhong, S., Zhu, J., Liang, J., Li, Q., Wang, Y., & Liu, H. (2020). Social and environmental risk factors for road traffic injuries among children under five in rural China. Medicine, 99(17), e19825. https://doi.org/10.1097/MD.0000000000019825

- Loa, P., & Habib, K. N.(2023). Identifying the Determinants of Anticipated Post-Pandemic Mode Choices in the Greater Toronto Area: A Stated Preference Study. Transportation Research Record, 2677(6), 199-217. https://doi.org/10.1177/03611981221145133

- Lorenc, T., Brunton, G., Oliver, S., Oliver, K., & Oakley, A. (2008). Attitudes to walking and cycling among children, young people and parents: a systematic review. Journal of Epidemiology & Community Health, 62(10), 852-857. https://doi.org/10.1136/jech.2007.070250

- 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), 862. https://doi.org/10.1186/1471-2458-12-862

- Mehdizadeh, M., Fallah Zavareh, M., & Nordfjaern, T. (2019). School travel mode use: direct and indirect effects through parental attitudes and transport priorities. Transportmetrica A: Transport Science, 15(2), 749-775. https://doi.org/10.1080/23249935.2018.1529838

- Mehdizadeh, M., Mamdoohi, A., & Nordfjaern, T. (2017). Walking time to school, children's active school travel and their related factors. Journal of Transport & Health, 6, 313-326.

https://doi.org/10.1016/j.jth.2017.01.012

- Mitra, R., & Buliung, R. N. (2015). Exploring differences in school travel mode choice behaviour between children and youth. Transport Policy, 42, 4-11. https://doi.org/10.1016/j.tranpol.2015.04.005

- Mitra, R., & Manaugh, K. (2020). Chapter Five - A social-ecological conceptualization of children's mobility. In E. O. D. Waygood, M. Friman, L. E. Olsson, & R. Mitra (Eds.), Transport and Children's Wellbeing (pp. 81-100). Elsevier. https://www.sciencedirect.com/science/article/abs/pii/B9780128146941000051

- Mitra, R., Moore, S. A., Gillespie, M., Faulkner, G., Vanderloo, L. M., Chulak-Bozzer, T., Rhodes, R. E., Brussoni, M., & Tremblay, M. S. (2020). Healthy movement behaviours in children and youth during the COVID-19 pandemic: Exploring the role of the neighbourhood environment. Health & Place, 65, 102418. https://doi.org/10.1016/j.healthplace.2020.102418

- Morrison, C. N., Thompson, J., Kondo, M. C., & Beck, B. (2019). On-road bicycle lane types, roadway characteristics, and risks for bicycle crashes. Accident Analysis & Prevention, 123, 123-131. https://doi.org/10.1016/j.aap.2018.11.017

- Muñoz-Galiano, I. M., Connor, J. D., Gómez-Ruano, M. A., & Torres-Luque, G. (2020). Influence of the Parental Educational Level on Physical Activity in Schoolchildren. Sustainability, 12(9), 3920. https://doi.org/10.3390/su12093920

- Musau, H., Mwakalonge, J., Comert, G., & Siuhi, S. (2024). A national survey on the effect of the COVID-19 pandemic on school travel in the US. – Parents perspective. Transportation Research Interdisciplinary Perspectives, 24, 101061. https://doi.org/10.1016/j.trip.2024.101061

- Nevelsteen, K., Steenberghen, T., Van Rompaey, A., & Uyttersprot, L. (2012). Controlling factors of the parental safety perception on children's travel mode choice. Accident Analysis & Prevention, 45, 39-49. https://doi.org/10.1016/j.aap.2011.11.007

- Nguyen, M. H., Pojani, D., Nguyen, T. C., & Ha, T. T. (2021). The impact of Covid-19 on children's active travel to school in Vietnam. Journal of Transport Geography, 96, 103191. https://doi.org/10.1016/j.jtrangeo.2021.103191

- Oluyomi, A. O., Lee, C., Nehme, E., Dowdy, D., Ory, M. G., & Hoelscher, D. M. (2014). Parental safety concerns and active school commute: correlates across multiple domains in the home-to-school journey. International Journal of Behavioral Nutrition and Physical Activity, 11(1), 32. https://doi.org/10.1186/1479-5868-11-32

- Ravensbergen, L., Buliung, R. N., Wilson, K., & Faulkner, G. (2016). Socioeconomic Discrepancies in Children's Access to Physical Activity Facilities: Activity Space Analysis. Transportation Research Record: Journal of the Transportation Research Board, 2598(1), 11-18. https://doi.org/10.3141/2598-02

- 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

- 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

- Shamshiripour, A., Rahimi, E., Shabanpour, R., & Mohammadian, A. (2020). How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. Transportation Research Interdisciplinary Perspectives, 7, 100216. https://doi.org/10.1016/j.trip.2020.100216

- Sims, D., & Bopp, M. (2020). Using parental active travel behavior and beliefs to predict active travel to school among children. International Journal of Sustainable Transportation, 14(5), 343-348. https://doi.org/10.1080/15568318.2018.1558469

- Sweeney, S. M., & Von Hagen, L. A. (2016). Stranger Danger, Cell Phones, Traffic, and Active Travel to and from Schools: Perceptions of Parents and Children. Transportation Research Record, 2582(1), 1-7. https://doi.org/10.3141/2582-01

- te Brömmelstroet, M., Nikolaeva, A., Glaser, M., Nicolaisen, M. S., & Chan, C. (2017). Travelling together alone and alone together: mobility and potential exposure to diversity. Applied Mobilities, 2(1), 1-15. https://doi.org/10.1080/23800127.2017.1283122

- Tsai, P. Y. (2022). The association between family routines and parents' different working hour schedules. Children & Society, 36(6), 1156-1176. https://doi.org/10.1111/chso.12565

- 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), 1026. https://doi.org/10.3390/ijerph20021026

- Waygood, E. O. D., Van Den Berg, P., & Kemperman, A. (2021). The social dimensions of children's travel. 8, 71-100. https://doi.org/10.1016/bs.atpp.2021.06.002

- Westman, J., Friman, M., & Olsson, L. E. (2017). What Drives Them to Drive?—Parents' Reasons for Choosing the Car to Take Their Children to School. Frontiers in Psychology, 8, 1970. https://doi.org/10.3389/fpsyg.2017.01970

- Xi, H., Li, Q., Hensher, D. A., Nelson, J. D., & Ho, C. (2023). Quantifying the impact of COVID-19 on travel behavior in different socio-economic segments. Transport Policy, 136, 98-112. https://doi.org/10.1016/j.tranpol.2023.03.014

- Zarbalizade, E. (2021). Consumer Value Comparison of Private Vehicles and Public Transport in Suburban Transportation. Economic scope. https://www.academia.edu/94798652/Consumer_Value_Comparison_of_Private_Vehicles_and_Public_Transport_in_Suburban_Transportation

- Zhang, S., Jing, P., Yuan, D., & Yang, C. (2022). On parents' choice of the school travel mode during the COVID-19 pandemic. Mathematical biosciences and engineering: MBE, 19(9), 9412-9436. https://doi.org/10.3934/mbe.2022438