ALL IN ALL – IT'S JUST ANOTHER WALK TO THE SCHOOL: UNCOVERING THE LINK BETWEEN EDUCATIONAL ACCESS AND TRAVEL BEHAVIOUR ACROSS PRAGUE'S SUBURBAN AREAS

JAN BITTNER *

*Czech Technical University in Prague, Jugoslávských partyzánů 1580/3,
160 00 Prague 6 – Dejvice, Czechia*
∗ Corresponding author: jan.bittner@cvut.cz

1. Introduction

Residential car dependency is a significant challenge to achieving sustainable urban mobility, especially in suburban areas. Its negative impacts include energy consumption [1], land-use inefficiency [2], public health [3], deepening socio-economic polarization [4], all hindering the transition to resilient and inclusive urban mobility. This research focuses on Prague's suburban areas, specifically exploring the relationship between accessibility to primary educational amenities and parental transport behaviour, measured through both car dependency and public transport (PT) use frequency.

Urban planning concepts like the 15-minute city [5] or Transit-Oriented Development (TOD) [6] aim to address car dependency by improving access to essential services and amenities, but their real-world impact on transport behaviour, particularly in suburban environments, is still not fully understood. This study adds new insights by examining parental travel behaviour using travel diaries and regression models, focusing on how proximity to primary educational facilities correlates with both car and PT used in the Prague suburban area.

2. Materials and Methods

The dataset comprises geolocated travel diaries from parents living in Prague's suburban areas. The research applies three regression models to analyse parental transport behaviour, focusing on the following dependent variables:

a) Model A: **Car Use Frequency**: Measured on a 5-point scale (> 3 times per week, 1 - 3 times per week, 1 - 3 times per month, < 1 time per month, Never)
b) Model B: **Public Transport Use Frequency**: Measured on the same scale as car use frequency.
c) Model C: *Ratio between Car and PT Use Frequency*: A matrix-based ratio derived from the car use and PT use scales. See the matrix below.

	PT > 3 TIMES PER WEEK	PT 1 - 3 TIMES PER WEEK	PT 1 - 3 TIMES PER MONTH	PT < 1 TIME PER MONTH	PT NEVER
CAR > 3 TIMES PER WEEK	0.50	0.67	0.90	0.97	0.97
CAR 1 - 3 TIMES PER WEEK	0.33	0.50	0.81	0.94	0.97
CAR 1 - 3 TIMES PER MONTH	0.10	0.19	0.50	0.80	0.97
CAR < 1 TIME PER MONTH	0.03	0.06	0.20	0.50	0.97
CAR NEVER	0.03	0.03	0.03	0.03	NA

Table 1 – Car and PT Use Ratio Matrix

The independent variables across the three models include [1]:

· **Sex** (dummy 1=female)
· **Driving licence possession** (dummy 1=yes)
· **Number of cars in the household**
· **House characteristics** – latent variable based on house type and size
· **Municipal suburban category** – according to suburbanisation zones defined by Ouředníček [7]
· Accessibility ratios for regional centres (PT/car) – latent variable based on accessibility
  to regional centres defined by the Central Bohemian Regional Plan [8]
· **Accessibility ratios for local centres (PT/car)** – latent variable based on accessibility
  to local centres defined by the Central Bohemian Regional Plan [8]
· **Respondent workplace accessibility ratio (PT/car)**
· **Municipal population density** – inhabitants per hectare
· **Walk time to the nearest primary educational facility** – categories for walk times
  ⩽6 minutes, 7–15 minutes, and ⩾16 minutes (base category).

The models (model A, model B, model C) were run for two subsamples: all parents (N=247) and
a subsample of parents with known "off-house" workplaces (N=152). This allows for a comparative
analysis between general parental travel behaviour and known workplaces.

---

[1] Other socio-economic variables were also considered (respondent education, age, household income, etc .);
however, none of them showed significance in any model.

3. Results

The results from the three models collectively highlight key factors that shape parental transport behaviour. Several variables consistently influence both car dependency and public transport (PT) use.

In **Model A** (Car Use Frequency), men are more likely to use cars than women, with an estimate of 0.6 for women ($p < 0.01$), indicating a notable gender difference in car use patterns. Having a driving licence strongly increases car dependency, with highly significant estimates of -4.593 ($p < 0.001$) for all parents and -7.426 ($p < 0.001$) for parents with known workplaces, suggesting that possessing a licence is a major determinant of car reliance. The number of cars in a household is another strong predictor of car use frequency, with estimates of -1.123 ($p < 0.001$) for all parents and -0.94 ($p = 0.013$) for parents with a known workplace, reinforcing the idea that car ownership directly correlates with higher car usage. House characteristics, such as size and type, are significant only for parents with known workplaces, with an estimate of -0.5 ($p < 0.1$), indicating that larger or more detached homes may increase car use. The accessibility ratio (PT/car) to regional and local centres also plays a critical role, with estimates of -0.45 ($p = 0.04$) and -0.38 ($p = 0.02$) in the full sample, showing that better public transport access to these centres reduces car dependency. Municipal population density becomes significant when combined with the workplace accessibility ratio (PT/car), reducing car use by an estimated -0.03 ($p < 0.05$). Finally, proximity to educational facilities significantly decreases car use, with estimates of around 1.4 ($p < 0.05$) for both short (<6 minutes) and moderate (7 – 15 minutes) walk times, emphasising the role of school accessibility in reducing car reliance.

In **Model B** (Public Transport Use Frequency), similar patterns emerge. Parents with a driving licence are less likely to use public transport, with estimates of 1.944 ($p = 0.005$) for all parents and 2.492 ($p = 0.006$) for those with known workplaces. The number of cars in a household remains a strong predictor of PT use, with an estimate of 0.44 ($p = 0.005$) for both samples, indicating that more cars lead to less PT usage. Living in more distant suburban areas correlates with lower PT use, with significant estimates of 0.288 ($p < 0.001$) for all parents and 0.195 ($p = 0.04$) for working parents. Interestingly, the regional centre accessibility ratio (PT/car) becomes significant only for the total sample, with an estimated 0.268 ($p = 0.054$). Conversely, municipal population density is significant only for parents with a known workplace, reducing car use by an estimated -0.017 ($p = 0.007$), indicating that denser areas promote public transport use. The workplace accessibility ratio (PT/car) is also important (estimate = 0.278, $p = 0.004$). Educational facility accessibility is essential for parents with known workplaces, where a 7–15 minute walk time has a significant estimate of -0.79 ($p = 0.041$), further supporting the idea that proximity to schools encourages public transport use.

In **Model C** (Car/PT Use Ratio), which focuses on the balance between car and PT use, several findings align with the previous models. Women are more likely to use PT relative to cars, with an estimate of -0.17 ($p < 0.1$) in both subsamples. Having a driving licence increases car use relative to PT, with significant estimates of 2.116 ($p < 0.001$) for all parents and 2.592 ($p < 0.001$) for working parents. Similarly, more cars in a household increase car use relative to PT, with estimates of 0.333 ($p < 0.001$) for all parents and 0.257 ($p = 0.01$) for parents with a known workplace. Suburban living is associated with a higher car/PT use ratio, with an estimate of 0.132 ($p = 0.003$) for all parents, though this effect is not significant for parents with known workplaces. Regional centre accessibility shows the same significance as in Model A, reducing the car/PT use ratio with an estimated 0.15 ($p < 0.001$) for all parents. Municipal population density significantly reduces car

dependency, with an estimate of -0.005 (p = 0.085) for all parents. Finally, workplace accessibility ratio (PT/car) significantly reduces car use relative to PT, with an estimate of 0.125 (p = 0.01), and proximity to schools is crucial in lowering the car/PT use ratio. A 7–15 minute walk time significantly reduces car use relative to PT, with estimates of -0.32 (p = 0.067) and -0.507 (p = 0.02), suggesting that moderate proximity to schools encourages parents to rely more on public transport.

In models B and C, a notable pattern emerged: only the 7–15 minute walk time to educational facilities was significant, while the 0–6 minute category was not. This may suggest that parents living within closer proximity to schools may not need to adjust their transport behaviour, as children residing within a short walking distance (0–6 minutes) are likely permitted to travel independently, thus negating the need for a car journey or public transport accompaniment.

Overall, these results demonstrate the strong correlation of socio-economic factors, built environment characteristics, and educational facility accessibility with parental transport choices.

4. Discussion

The results indicate that educational facility accessibility significantly correlates (along with other built environment variables) with lower car dependency and higher public transport use. However, several limitations should be considered when interpreting these findings. The sample size is relatively small (N=247 and N=152), which may affect the generalizability of the results. Furthermore, while the focus is on educational facilities, the proximity of other amenities, such as shops or healthcare services, could also influence transport behaviour. The categories for car and public transport use frequency in the analysis are broad and not equally spaced, potentially limiting the precision in capturing nuanced transport behaviours. Additionally, this study only considers car and public transport use, excluding other travel modes such as cycling or walking, which could offer further insights into suburban transport behaviour. Finally, the research identifies correlations rather than causal relationships, meaning that other factors, such as individual attitudes or the availability of other amenities, may also be contributing to the observed patterns. Future studies should aim to address these limitations better to understand the complex dynamics between accessibility and transport behaviour.

5. Conclusion

This research proves that proximity to primary educational facilities significantly correlates with parental transport behaviour, reducing car dependency and increasing public transport use. These findings support the integration of educational accessibility into urban planning strategies aimed at promoting sustainable mobility, particularly in suburban areas where car dependency is more prevalent. By addressing both socioeconomic factors and built environment characteristics, cities can create more resilient and inclusive mobility patterns that align with the principles of urban sustainability.

References

[1] MINDALI, Orit, Adi RAVEH a Ilan SALOMON. Urban density and energy consumption: a new look at old statistics. *Transportation Research Part A: Policy and Practice* [online]. 2004, *38*(2), 143–162. ISSN 09658564. Dostupné z: doi:10.1016/j.tra.2003.10.004

[2] EUROPEAN ENVIRONMENT AGENCY. a SWISS FEDERAL OFFICE FOR THE ENVIRONMENT (FOEN). *Urban sprawl in Europe: joint EEA FOEN report*. [online]. LU: Publications Office, 2016 [vid. 2023-07-08]. Dostupné z: https://data.europa.eu/doi/10.2800/143470

[3] EWING, Reid, Richard A SCHIEBER a Charles V ZEGEER. Urban Sprawl as a Risk Factor in Motor Vehicle Occupant and Pedestrian Fatalities. *American Journal of Public Health*. 2003, *93*(9).

[4] DE BOER, Enne. *Transport Sociology: Social Aspects of Transport Planning*. Burlington: Elsevier Science, 2013. ISBN 978-1-4831-6060-3.

[5] POZOUKIDOU, Georgia a Zoi CHATZIYIANNAKI. 15-Minute City: Decomposing the New Urban Planning Eutopia. *Sustainability* [online]. 2021, *13*(2), 928. ISSN 2071-1050. Dostupné z: doi:10.3390/su13020928

[6] POJANI, Dorina a Dominic STEAD. Past, Present and Future of Transit-Oriented Development in Three European Capital City-Regions. In: *Advances in Transport Policy and Planning* [online]. B.m.: Elsevier, 2018 [vid. 2023-07-08], s. 93–118. ISBN 978-0-12-815294-2. Dostupné z: doi:10.1016/bs.atpp.2018.07.003

[7] OUŘEDNÍČEK, Martin. *Zones of residential suburbanisation 2016* [online]. [map]. 2016. Dostupné z: https://www.atlasobyvatelstva.cz/cs/zony-2016

[8] *Central Bohemian Regional Plan (Zásady územního rozvoje)* [online]. [map]. B.m.: Středočeský kraj. 2023. Dostupné z: https://kr-stredocesky.cz/web/uzemni-planovani/10.-aktualizace-zasad-uzemniho-rozvoje-stredoceskeho-kraje