

TRANSPORT FINDINGS

Are Adolescents' Decisions to Cycle to School Linked to Their Parents' Cycling Behaviour?

Sapan Tiwari, Ph.D.¹, Nikhil Chand², Afshin Jafari, Ph.D.¹¹ Centre for Urban Research, RMIT University, ² School of Engineering, RMIT University

Keywords: Adolescents, Mode Choice, Bicycle riding, Parental Influence

<https://doi.org/10.32866/001c.147116>

Findings

This study examines whether adolescents are more likely to cycle to school when their parents do, and whether this influence differs between female and male adolescents. Using 3,017 school trips from the Victorian Integrated Survey for Travel and Activity (VISTA), separate multinomial logit models were estimated for each group. Findings show that parental cycling significantly increases adolescents' likelihood of cycling, with a stronger effect for females. These findings demonstrate that parental behaviour plays a crucial role in shaping active school travel.

1. Questions

Cycling offers an accessible way for adolescents to be physically active and contributes to healthier and more sustainable cities (Loh et al. 2022). Yet cycling rates among adolescents have declined in many regions, especially the car-dominant settings (Schmassmann, Baehler, and R  rat 2024). Adolescence marks a period of growing independence, but parents remain key decision-makers who often shape or constrain these choices (Woldeamanuel 2016). Parental influence operates both through perceptions and through behaviour, and their perception of safety and infrastructure is decisive in determining whether adolescents engage in active travel (Klos et al. 2023; Sukmayasa, Soza-Parra, and Ettema 2025). There is also evidence that adolescents are more likely to cycle when cycling is already part of family routines and mobility practices (Luo and Dai 2025). While travel socialisation includes broader social, cultural, and environmental factors, this study focuses specifically on parents' cycling behaviour (Panter, Jones, and Van Sluijs 2008). However, there is limited evidence on this from low-cycling countries such as Australia. Therefore, this study aims to address two guiding questions:

1. How is adolescents' likelihood of cycling to school related to their parents' cycling behaviour in Greater Melbourne?
2. Does this relationship differ between male and female adolescents in Greater Melbourne?

2. Methods

Trips from Victorian Integrated Survey for Travel and Activity (VISTA)¹ (2012–2020) were used to estimate mode-choice for adolescents (aged 11–17) in Greater Melbourne. VISTA is a household travel survey that collects all trips made by all household members across a detailed one-day travel diary. It includes socio-demographic and household information, and fine-grained origin–destination (OD) data at the Mesh Block (MB) level². All school trips were extracted, resulting in 3,017 observations across four alternatives: car, Public Transport (PT), walking, and cycling.

Travel times were estimated using the *r5* routing engine via the *r5r* package in R, which combines Open Street Map (OSM) and General Transit Feed Specification (GTFS) data and applies the RAPTOR algorithm for PT routing (Pereira et al. 2021) (see Supplementary Material). Driving and walking times were based on road speed limits and pedestrian networks. Cycling times were derived using the network-based impedance model from Jafari, Pemberton, et al. (2025). For PT travel cost, the average fare in Greater Melbourne (2012–2020) was AUD 4 per trip (AUD 8 per day). Driving costs were calculated using ATAP distance-based fuel consumption rates³ and average fuel prices in Victoria (2012–2020) from the Australian Institute of Petroleum⁴.

Mode choice behaviour was analysed using a Multinomial Logit (MNL) model. Explanatory variables included travel time, monetary cost, household vehicle availability, and parental cycling activity (number of cycling trips by parents on the survey day). Each variable enters the utility function with an estimated coefficient (weight), representing its contribution to mode utility. The utility of an individual i choosing mode j is:

$$U_{ij}^{(m)} = ASC_j + \beta_{TT,j} T_{ij} + \beta_{money} \left(\frac{C_{ij}}{H_i} \right) \delta_j^{\text{cost}} + \beta_{CA} NC_i \delta_j^{\text{car}} + \left(\beta_{\text{parent}} x_{\text{parent},i} + \beta_{BA} NB_i + \gamma^{(m)} \beta_{\text{sex}} S_i \right) \delta_j^{\text{bike}} \quad (1)$$

Where:

$U_{ij}^{(m)}$ is the utility of mode j for individual i under model m ;

ASC_j is the alternative-specific constant for mode j ;

¹ Victorian Integrated Survey of Travel and Activity (VISTA), Victorian Government: <https://www.vic.gov.au/victorian-integrated-survey-travel-and-activity>

² Mesh Blocks are the smallest geographic areas defined by the Australian Bureau of Statistics (ABS) and form the building blocks for the larger regions of the Australian Statistical Geography Standard (ASGS).

³ https://www.atap.gov.au/sites/default/files/pv2_road_parameter_values.pdf

⁴ <https://aip.com.au/aip-annual-retail-price-data>

T_{ij} is the travel time for individual i by mode j ;

$\frac{C_{ij}}{H_i}$ is the monetary cost of mode j for individual i , C_{ij} , divided by individual i 's household income, H_i ;

$x_{\text{parent},i}$ is the number of cycling trips made by parents of individual i in a day;

NB_i and NC_i are the number of bicycles and cars in the household, respectively;

S_i is the sex of individual i (1 = male, 0 = female);

$\gamma^{(m)}$ equals 1 if Model $m = 1$, and 0 otherwise;

$\delta_j^{\text{cost}} = 1$ if mode j is PT or car, and 0 otherwise;

$\delta_j^{\text{bike}} = 1$ if mode j is bike, and 0 otherwise;

$\delta_j^{\text{car}} = 1$ if mode j is car, and 0 otherwise.

The estimated parameters are $\beta_{\text{TT},j}$ (travel time), $\beta_{\text{money},j}$ (monetary cost), β_{parent} (coefficient on parental cycling behaviour), β_{BA} (bike availability), and β_{CA} (car availability).

Alongside the main model, two sex-specific models were estimated, excluding sex as an attribute (Models 2 and 3). Predictive probabilities were then calculated as the percentage change in cycling likelihood resulting from variations in specific attributes, while keeping others constant.

3. Findings

Cycling is used by 3.87% of adolescents (117 out of 3,017) for school trips, with a clear gender gap, with male adolescents cycling nearly three times more than females (5.66% (90 out of 1573) vs. 1.90% (27 out of 1444)) ([Table 1](#)).

The model results confirm the strong influence of parental cycling on adolescents' mode, with clear gender differences ([Table 2](#)). In Model 1, $\beta_{\text{parent}} = 0.450$ indicates that parental cycling behaviour substantially increases the likelihood of cycling. The inclusion of $\beta_{\text{sex}} = 1.104$ in Model 1 confirms that males are more likely to cycle overall.

In sex-specific models, the effect is larger and statistically stronger among females ($\beta_{\text{parent}} = 0.649$), while it is weaker and only marginally significant for male adolescents ($\beta_{\text{parent}} = 0.303$), suggesting that parental cycling has a greater impact on female adolescents.

Table 1. Mode shares and summary statistics across different scenario thresholds

Variables	All adolescents (n=3017)		Male adolescents (n=1573)		Female adolescents (n=1444)	
	Mean	SD	Mean	SD	Mean	SD
Mode Shares (%)						
Cycling	3.87	-	5.66	-	1.90	-
Driving	56.58	-	53.12	-	60.3	-
PT	21.21	-	22.47	-	19.84	-
Walking	18.32	-	18.73	-	17.86	-
Individual Characteristics						
Sex (1 = male)	0.521	0.499	-	-	-	-
Household Characteristics						
Bike Ownership (avg.)	2.84	2.02	2.92	2.05	2.88	2.01
Car Ownership (avg.)	2.03	0.86	2.00	0.86	2.02	0.83
Weekly Income (AUD)	2355.7	1590.33	2373.9	1566.2	2329.2	1581.2

Table 2. Estimated mode choice parameters across different models

Coefficient	Model 1	Model 2: Female	Model 3: Male
ASC_{PT}	-1.535*** [-1.848, -1.223]	-1.379*** [-1.836, -0.922]	-1.668*** [-2.105, -1.230]
ASC_{bike}	-2.841*** [-3.540, -2.143]	-2.534*** [-3.833, -1.235]	-1.866*** [-2.553, -1.179]
ASC_{walk}	2.105*** [1.756, 2.454]	2.414*** [1.888, 2.940]	1.854*** [1.384, 2.324]
$\beta_{TT,car}$	-0.057*** [-0.069, -0.045]	-0.053*** [-0.071, -0.035]	-0.063*** [-0.079, -0.046]
$\beta_{TT,PT}$	0.001 [-0.001, 0.004]	0.001 [-0.005, 0.006]	0.002 [-0.002, 0.005]
$\beta_{TT,bike}$	-0.118*** [-0.151, -0.086]	-0.171*** [-0.264, -0.077]	-0.109*** [-0.144, -0.074]
$\beta_{TT,walk}$	-0.084*** [-0.094, -0.075]	-0.093*** [-0.109, -0.078]	-0.078*** [-0.090, -0.066]
β_{parent}	0.450*** [0.199, 0.700]	0.649** [0.219, 1.079]	0.303* [-0.037, 0.643]
β_{money}	6.499 [-17.345, 30.344]	10.561 [-18.371, 39.493]	-3.541 [-45.875, 38.793]
β_{CA}	0.225*** [0.115, 0.335]	0.299*** [0.132, 0.467]	0.156* [0.008, 0.304]
β_{BA}	0.248*** [0.149, 0.346]	0.293** [0.079, 0.507]	0.225*** [0.114, 0.337]
β_{sex}	1.104*** [0.586, 1.622]	-	-
R^2	0.392	0.4379	0.3539
LL	-1866.95	-834.99	-1024.13
AIC	3757.91	1691.99	2070.26

Notes: Coefficients are reported with 95% confidence intervals in brackets. Significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $\cdot p < 0.10$.

Other attributes behave as expected. Travel time has a negative effect across modes, with females more sensitive to cycling time. Cost is not a significant factor for adolescents, unlike the findings for adults in Greater Melbourne (Jafari, Singh, et al. 2025).

[Fig. 1\(a\)](#) shows that the probability of cycling declines as bicycle travel time increases. However, higher parental cycling behaviour shifts the curves upward, indicating that adolescents exposed to more parental cycling activity are more likely to cycle, even for longer trips. The dashed line marks the sample-average travel time. In [Fig. 1\(b\)](#), the probability of cycling increases with household bicycle ownership, with a noticeably stronger effect under a higher number of cycling trips by parents.

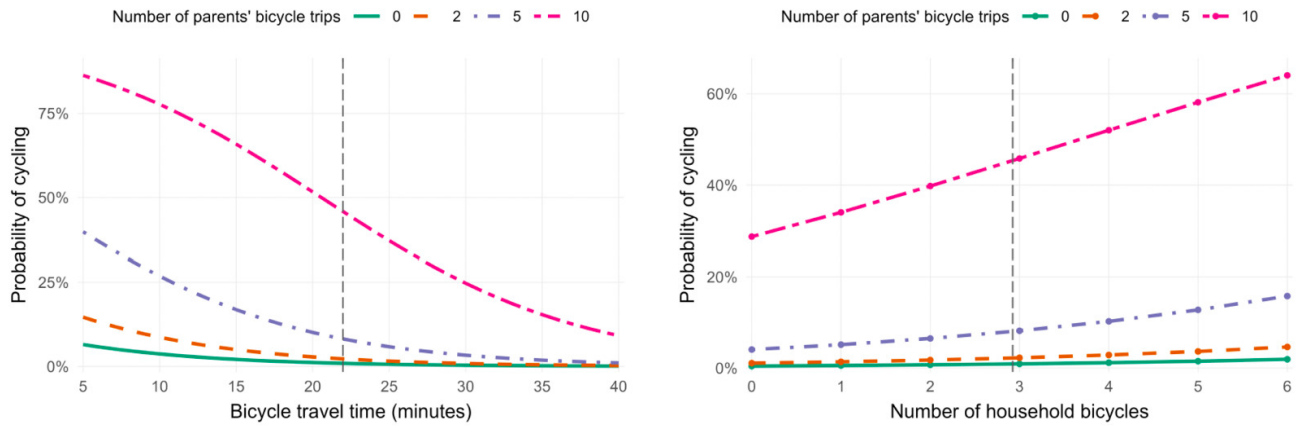


Figure 1. Probability of adolescents cycling to school by (a) bicycle travel time and (b) number of household bicycles, for different numbers of parents' daily bicycle trips.

Overall, findings suggest that adolescents are more likely to cycle when cycling is present in their household environment (Tiwari et al. 2025; Schmassmann, Baehler, and R  rat 2024).

Acknowledgements

Afshin Jafari and Sapan Tiwari are supported by an RMIT Vice-Chancellor's Research Fellowship. Nikhil Chand is supported by an Australian Government Research Training Program Scholarship.

Submitted: October 22, 2025 AEDT. Accepted: November 11, 2025 AEDT. Published: November 14, 2025 AEDT.



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SUPPLEMENTARY MATERIALS

Supplementary

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