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The impact of Covid-19 on children's active travel to school in Vietnam

Minh Hieu Nguyen a,*, Dorina Pojani b, Thanh Chuong Nguyen a, Thanh Tung Ha a

a Faculty of Transport Economics, University of Transport and Communications, No. 3 Cau Giay Street, Dong Da District, Hanoi, Vietnam
b The University of Queensland, Brisbane, Australia

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ABSTRACT

This is among the first studies to provide empirical evidence on active school travel rates and determinants before and after the first Covid-19 lockdown in spring 2020. We have collected and analyzed primary survey data on the school travel patterns of 472 school-age children in Hanoi, Vietnam. The findings show that the Covid-19 pandemic has been quite detrimental: once schools reopened, the prevalence of active school travel decreased from 53% to less than 31%. Where parents, especially mothers, did not face barriers to motorized travel, they assumed the role of chauffeur. Parents who were more concerned about community infections were more motivated to shift children to motorized modes. Walking was more affected than cycling because it was seen as more likely to lead to physical contact and virus transmission. Active school travel dropped more steeply in urban districts (as opposed to poorer, non-urban districts) and in those areas where home-school distances were the largest. It appears that the most common perceptions around barriers to active school travel have been exacerbated during the pandemic as parents and children adapt to “the new normal”.

1. Introduction

A novel coronavirus was first detected in December 2019 in Wuhan, China. From that point onwards, it spread so rapidly that, on 11 March 2020 the World Health Organization was forced to declare a pandemic of COronaVIrus Disease, year 2019 (Covid-19). To contain infections and reduce person-to-person transmission, many countries implemented more or less strict lockdowns throughout the spring season of 2020. By the end of 2020, social distancing measures were ongoing nearly everywhere (De Vos, 2020). In conjunction, many countries mandated nationwide school closures of varying duration. By 18 March 2020, schools had shut down in 107 countries (Viner et al., 2020).

Anecdotal evidence suggests that school closures and the home-schooling that ensued have had major implications for active school travel - during the Covid-19 lockdown but also after pupils were allowed to return to school. There is concern that active travel habits formed earlier may have been reversed or weakened (Jia et al., 2021). Due to parental fears around virus transmission in open spaces, children may be travelling by car more than before. If these assumptions are correct, the consequences in terms of sustainability will be disastrous, especially in developing cities which were already fighting an uphill battle with automobility before the pandemic (see Stead and Pojani, 2017).

Given that contemporary urban children are spending less and less time in unstructured play outdoors, walking and cycling to school is very desirable in that it provides a way to incorporate some physical exercise into pupils’ daily routines (Faulkner et al., 2009; Larouche et al., 2014). Also, where children reach schools on foot or by bicycle, the school surroundings are less congested, chaotic and polluted (Lopez and Wong, 2017). In addition to meeting current public health and sustainability goals, active travel at an early age may lead to more walking and cycling in adulthood (Black et al., 2001; Beige and Axhausen, 2012).

Unfortunately, international studies generally report relatively low and declining rates of active travel to school (see, among others, Fyhri et al., 2011 on Denmark, Norway, Finland, and Great Britain; van der Ploeg et al., 2006 on Australia; McDonald et al., 2011 on the US; Costa et al., 2012 on Brazil; Trang et al., 2012 on Vietnam; Leung and Loo, 2020 on Hong Kong). Places such as Albania (Pojani and Boussauw, 2014) and Ghana (Siiba, 2020), which retain very high rates of active school travel, are outliers. However, they too may have been impacted by Covid-19.

This is among the very first studies to provide empirical evidence on active school travel before and after the first Covid-19 lockdown. We have collected and analyzed primary survey data on the school travel patterns of 472 school-age children in Hanoi, Vietnam. To date, a single study on the topic of active travel to school has been set in Vietnam, which, however, considers Ho Chi Minh City rather than Hanoi. That...
study reports a notable decrease in the prevalence of active commuting between 2004 and 2009: from 28% to 20% (Trang et al., 2012). But Hanoi does not necessarily resemble Ho Chi Minh City in terms of travel behavior because the two cities differ in their size, economic base, and history.

In addition to estimating active school commuting rates and determinants in Hanoi, the present study answers the following research questions: Have Covid-19-related school closures produced changes in modal split among children, and what are those changes? What has been the prevalence of active travel after the reopening of schools? Have children shifted from active to non-active travel, and why? The answers to these questions will contribute to a more holistic understanding of the effects of the pandemic on travel behavior. As such, they may help policymakers to formulate policies in support of active school travel in a post-pandemic world.

2. Background

To place this study in context, we review the literature on active school travel (hereafter referred to as AST) under normal circumstances, and report some of the known impacts of the Covid-19 pandemic on transport systems and travel in cities around the world. Then we proceed to describe the study method and present the findings.

2.1. Active school travel (AST) under normal circumstances

School commutes, whether active or not, have been widely researched, and several systematic reviews are available in addition to case study reports (Lopez and Wong, 2017; Aranda-Balboa et al., 2020; D’Haese et al., 2015). Here, we reiterate some of the most common factors that have been found to influence AST. These are grouped into ‘child characteristics’, ‘vehicle ownership’, ‘parental traits’, and ‘environmental factors’.

2.1.1. Child characteristics

Generally, boys are more likely to walk or cycle to school compared with girls (Babey et al., 2009; Larsen et al., 2009; Siiba, 2020) because parents are generally more protective of girls while allowing boys to be more independent (Brown et al., 2008; Foster et al., 2014; Fyhri and Hjorthol, 2009; Mackett et al., 2007; Prezza et al., 2001). However, some studies report that gender is not a significant variable (Carver et al., 2019; Leung and Loo, 2020; Pojiani and Boussauw, 2014; Potoglou and Arslangulova, 2017). With regard to age, studies tend to find that older children are more likely to engage in AST (Leung and Loo, 2020; Potoglou and Arslangulova, 2017; Siiba, 2020) whereas very young children are more often driven to school by adults.

2.1.2. Vehicle ownership

A child living in a car-owning household is less likely to engage in AST (Carver et al., 2019; Pojani and Boussauw, 2014; Waygood and Susilo, 2015). However, a few studies do not find car-ownership to be a significant predictor of AST (Leung and Loo, 2020; Timperio et al., 2006). One study (Singh and Vasudevan, 2018), finds that motorcycle ownership is also associated with less AST. Although active transport encompasses cycling, bicycle ownership has been rarely considered in research on AST (exceptionally, Carver et al., 2019 considered this variable but found it not significant).

2.1.3. Parental traits

Mothers, who are short on time (e.g., because they work full-time), tend to allow their children to travel to school independently – which often translates into AST (Han et al., 2019). But in some cases, busy mothers with full-time jobs, who refuse to allow children to walk or cycle on their own, will drive them to school in order to save time (Potoglou and Arslangulova, 2017; Siiba, 2020). In addition to time poverty, parental attitudes around traffic safety and security from crime and harassment have a strong influence on whether children walk or cycle to school (Hsu and Saphores, 2014). More fearful parents, especially mothers, tend to drive their children to school (Hsu and Saphores, 2014; Pojani and Boussauw, 2014). Also, where traffic is free-flowing (as opposed to congested) along the routes to school, parents tend to drive their children, as it is quick and convenient to do so (Waygood and Susilo, 2015). Mothers and fathers often differ in their views about AST (Aibar Solana et al., 2018).

2.1.4. Environmental factors

A large home-school distance is one of the strongest barriers to AST whereas short home-school distances are known to promote walking and cycling (McDonald, 2008; Singh and Vasudevan, 2018; Babey et al., 2009; Larsen et al., 2009; Stewart et al., 2012; Easton and Ferrari, 2015). For this reason, urban children tend to engage in AST more than rural children (Potoglou and Arslangulova, 2017; Siiba, 2020). In some cities, school consolidation is leading to more spread out locations, thereby increasing home-school distances and undermining AST (Fyhri et al., 2011). But, what does a “short distance” mean? Studies report different thresholds, ranging from 3.2 km (2 miles) (Babey et al., 2009; Sener et al., 2019) to 1.6 km (1 mile) (Potoglou and Arslangulova, 2017; McDonald, 2008; Siiba, 2020; Mitra and Buljung, 2015). These differences may owe to attitudes, personal fitness, culture, urbanization, and environment (e.g., the presence of facilities dedicated to walking and cycling along the home-school route).

2.2. Impacts of Covid-19 on urban transport

While little is known, as of now, of the Covid-19 impact on AST, some studies have already examined the effect of the pandemic on urban transport more broadly. Typically, they have relied on third party data collected by companies like Apple or Google (Sipe, 2020) or through electronic tickets and membership cards (Teixeira and Lopes, 2020), rather than targeted population surveys.

Given mobility restrictions, cancellations of major public events, and mass adoption of e-activities, travel demand has decreased dramatically (Beck et al., 2020; Nguyen, 2021; Nguyen et al., 2021; Nguyen and Armoogum, 2021a). But different modes have been impacted differently. Public transport has suffered the most as people shun crowded, enclosed spaces in which the risk of infection may be the highest. In Australia’s largest cities, bus, tram, and train ridership has declined by 80–89% and so far shows little sign of recovery (Sipe, 2020).

As people turn away from public transport, they have embraced individual modes, which minimize interaction with others. Individual transport encompasses both cars and micromobility. In post-lockdown Australian cities, driving levels have already exceeded pre-pandemic levels (Sipe, 2020). In South Korea, car sales in March–April 2020 were higher than during the same period the previous year (Sung and Monschauer, 2020). These reports are troubling, but the picture is not all negative. Cycling has grown too. In Philadelphia bicycle sales have doubled, whereas in Wuhan bikeshearing demand has increased tenfold (Sung and Monschauer, 2020). In New York, both bikeshearing demand and cycling trip durations have gone up (Teixeira and Lopes, 2020). Anecdotally, electric scooters have also experienced a surge in popularity (Sipe, 2020).

In this study, we set to investigate whether an upward tick in active travel among adults is also reflected in AST – employing Hanoi as a case study.

3. Methodology

Hanoi, the capital of Vietnam, has a metropolitan population in excess of 7.3 million. The city is motorcycle-oriented whereas bus and bicycle use is low (Nguyen et al., 2020b; Nguyen et al., 2019; Nguyen and Armoogum, 2020; Nguyen and Pojani, 2018). Alarmingly, car ownership is rapidly growing, with severe repercussions on congestion,
parking, and pollution (OECD, 2018). On the positive side, the use of e-bikes is growing among Hanoi children – mirroring trends in other Vietnamese cities such as Hoi An and Ho Chi Minh City (Vu and Man Nguyen, 2018).

In 23 January 2020, schools in Hanoi closed for a week to celebrate the Vietnamese Lunar New Year. Once the holiday was over, the Ministry of Education and the Hanoi City Council requested that children remain at home to avoid contracting Covid-19. Schools started reopening on 4 May 2020, once the city marked one month of no community transmissions. The survey for this study was conducted soon afterwards (Fig. 1).

Invitations were sent to some schools in both urban and non-urban districts. One school in a non-urban district, which includes both primary and secondary grades, agreed to cooperate with the research team. The administrators were then asked to distribute the questionnaire to all the parents of pupils in grades 1 through 9 (6–15 years old). No financial incentives were provided for participation. Data in urban districts was gathered via snowball sampling. The questionnaire was posted online in Google Forms, and twenty work colleagues of the researchers, who have school-age children, were invited to participate. All agreed and, upon completion, shared the survey link with friends and relatives in Hanoi.¹

New participants recruited in this manner were asked to keep sharing the survey link forward (but not with co-workers, to avoid a bias toward particular workplaces). Single parents were excluded as their share is minuscule in Hanoi.

The survey closed on 29 May, after two weeks of data collection. In total, 506 parents responded. Out of these, 25 were excluded because they did not live in Hanoi at the time of the survey. This reduced the sample to 481 parents and 736 children aged between 6 and 15. Children under 9 were deemed too young for AST (especially independent AST) and were therefore excluded. The final sample covered 472 children aged 9 to 15. While this is not a random sample, it is large enough

| Code | Urban districts | Children surveyed | Code | Urban districts | Children surveyed | Code | Non-urban district | Children surveyed |
|------|----------------|------------------|------|----------------|------------------|------|-------------------|------------------|
| 1    | Hoan Kiem      | 28               | 7    | Tay Ho         | 21               | 13   | Ung Ho           | 237              |
| 2    | Hai Ba Trung   | 11               | 8    | Bae Tu Liem    | 14               |      |                   |                  |
| 3    | Hoang Mai      | 23               | 9    | Nam Tu Liem    | 16               |      |                   |                  |
| 4    | Thanh Xuan     | 15               | 10   | Cau Giay       | 31               |      |                   |                  |
| 5    | Dong Da        | 28               | 11   | Ha Dong        | 12               |      |                   |                  |
| 6    | Ba Dinh        | 22               | 12   | Long Bien      | 14               |      |                   |                  |

¹ There was some concern that a web-based survey may introduce a bias toward parents with smartphone and internet access. However, this bias is expected to be marginal because most school in urban districts use smartphone applications (e.g., Zalo) as the main mode of contact with parents. For this reason, the overwhelming majority of parents own smartphones.
Parental concerns around traffic safety and personal security were not to reliably answer the research questions (Fig. 2). Also, the characteristics of the sample match Hanoi’s (see later).

The questionnaire used in the study contained three main parts. The first part recorded demographic characteristics, such as residential location, monthly household income, and vehicle ownership (cars, motorcycles, and bicycles). It also gathered information on parents’ education level and occupation, and the spatial-temporal flexibility of their work arrangements. With regard to the children, only the age and gender were recorded. In the second part of the survey, parents were asked rank on a five-point Likert scale: (a) the perceived risk of Covid-19 transmission, and (b) the estimated chance that children may forget their face mask if they travel to school independently. These questions were designed to measure parental concerns around Covid-19.

The third part of the survey was more specifically about AST. Parents reported the home-school distances and the districts in which their children’s schools were located. For each child, parents reported (a) the commute mode in the last school day before the survey, and (b) the main commute mode before the Covid-19 pandemic. Modes considered included walking, conventional bicycles, e-bikes, motorcycles, cars, school buses, and conventional buses. For the purpose of this study, AST was defined as walking and cycling and the survey combined the two modes. While e-bikes are sometimes lumped together with AST (Hoj et al., 2018), in reality this mode is rather passive and best described as ‘micromobility’ rather than active travel. Where children travelled to school by bus (typically a school bus), parents reported whether children reached the bus stop on foot (this was treated as AST).

The responses were first analyzed using descriptive statistics. Afterwards, we estimated two binary logit regression models in Stata 15.0. In the first model, the dependent variable was whether children shifted from AST to motorized modes to school when they returned to school in May 2020. The second model sought to identify whether and why children engaged in AST when they returned to school. The same list of independent variables was used in both models (age of children, bus use, vehicle ownership by type, household monthly income, mother’s work flexibility, home-school distance, school location, and attitudes around risk of infection). The findings are discussed below.

4. Findings

Below we report the descriptive statistics of the survey data, and the results of two binary logit regressions, which model AST behavior.

4.1. Descriptive statistics

The descriptive statistics are presented in Table 1. As seen, the gender split of the children included in the survey is about equal, and the average age is 12.1. The urban / non-urban split is also balanced. The sample distributions in terms of gender, age, and location are comparable to the general pupil population in Hanoi (Hanoi Statistics Office, 2019). Thus, the sample can be considered as representative of local children aged 9–15.

Nearly two thirds of the children in the sample (63%) live in carless households. About 37% of the children live in car-owning households (though only 8% own two cars or more). This level of car ownership is higher than the Hanoi average (around 11%) (Nguyen et al., 2020a). Motorcycle ownership is quite high and households with at least two motorcycles make up more than 75% of the sample. Bicycle ownership is quite high too, with 60% of households having at least one. School bus services are utilized by only 28 children (6% of the sample) and no children take conventional buses to school. Home-school distances are large at more than 1.5 km for the majority of children (65%). Based on reported incomes, most participating households can be considered as middle-class. Most children (41%) live in households earning $650–1000 per month. The figures for the three other income groups (low, high-middle, high) are similar, at around 18–22%. Generally, parents are quite concerned that children may forget to wear a mask on their way to school. Parents also fear that the risk of community infections is still high in Hanoi.

Table 1

Descriptive statistics.

| Variables                       | Description                        | Frequency | Percentage |
|---------------------------------|------------------------------------|-----------|------------|
| Gender                          | Male                               | 246       | 52         |
|                                 | Female                             | 226       | 48         |
| Age                             | 12 ± 2                             |           |            |
| Bus use                         | No                                 | 444       | 94         |
|                                 | Yes                                | 28        | 6          |
| Car ownership                   | 0                                 | 298       | 63         |
|                                 | 1                                 | 136       | 29         |
|                                 | ≥2                                | 38        | 8          |
| Motorcycle ownership            | 0 or 1                             | 110       | 23         |
|                                 | ≥2                                | 362       | 77         |
| Bicycle ownership               | 0                                 | 190       | 40         |
|                                 | ≥1                                | 282       | 60         |
| Monthly income (US$)            | <650                               | 102       | 22         |
|                                 | 650–1000                           | 196       | 41         |
|                                 | 1000–1500                          | 88        | 19         |
|                                 | ≥1500                              | 86        | 18         |
| Mother’s working flexibility    | Fixed time and fixed workplace     | 240       | 51         |
|                                 | Fixed time and flexible workplace  | 54        | 11         |
|                                 | Flexible time and fixed workplace  | 80        | 17         |
|                                 | Flexible time and flexible workplace / unemployed | 98 | 21 |
| School’s location               | Non-urban                          | 237       | 50         |
|                                 | Urban                              | 235       | 50         |
| Home-school distance            | <1                                | 59        | 13         |
|                                 | 1–1.5                              | 108       | 23         |
|                                 | >1.5                               | 305       | 65         |
| Child might forget mask to school | Yes                                | 374       | 80         |
|                                 | No                                 | 11        | 2          |
| Risk of community infection is still high | Yes                                | 374       | 80         |
|                                 | No                                | 11        | 2          |
| Active travel in pre-Covid-19   | Yes (walking and cycling)          | 252       | 53         |
|                                 | No                                 | 364       | 77         |
| Shift from active to            | Yes (motorized travel)             | 108       | 23         |
| motorized travel                | No                                 | 314       | 67         |
| Active travel in post-Covid-19  | Yes (walking and cycling)          | 158       | 33         |
|                                 | Walking (all the way)              | 46        | 10         |
|                                 | Cycling                            | 98        | 21         |
|                                 | Walking to bus stop                | 14        | 3          |

N = 472.

1 Mean.
2 Standard deviation.
3 Measured on a 5-point Likert scale and treated as a continuous variable in modelling.
and Melbourne (39%) (Carver et al., 2019). Pre-Covid-19, motorcycles accounted for 30% of school trips, and were certainly used more than cars. As schools reopened in May 2020, 23% of pupils shifted from active to non-active modes. The AST rate decreased to less than 31%, with cycling now becoming more popular than walking. Motorcycles became the dominant mode in school travel, with a usage rate of 42%. E-bike trips increased too, from 2% to 11%. Changes in bus- and car-based travel were marginal. As before, school buses were used only in 6% of trips. Regression models shed more light into these statistics.

### 4.2. Regression analysis 1 (shift from AST to motorized transport)

Table 2, left side column, presents the results of the first regression analysis. As anticipated, parental fears around the risk of infection are positively related to modal shifts among school children. Parents may believe (correctly or erroneously) that, if they ride or drive their children to school, they will have more control over what/who the child touches/ meets along the way and thus minimize the risk of exposure to Covid-19. Similarly, where parents believe that the children will not wear their masks if they travel to school independently, they are more likely to chauffeur them (to ensure that masks are regularly and properly used). Based on the p-values returned by the model, the first type of concern carries more weight. If parents believe that the risk of Covid-19 infection is high, they tend to keep children away from AST, regardless of whether a mask is used or not.

Children living in households that own motorized vehicles (cars or motorcycles) were more likely to shift to those upon returning to school, even where they had been allowed to engage in AST before the pandemic. On the other hand, bicycle ownership was negatively associated with a modal shift toward motorized modes. An explanation could be that bicycles are mainly used by children on their way to school (Hansen, 2017). It appears that most children who cycled to school before the pandemic continued to do so afterwards. Perhaps parents believe that social distancing guidelines can be more easily followed on a bicycle than on foot, especially if the child must walk through crowded sidewalks to reach the school. Also, bicycle trips are of shorter duration than walking trips – a factor which may also be seen to minimize exposure to the virus. The physical distance between home and school is important too. Children who had to walk or cycle more than 1.5 km to school were more likely to shift to motorized modes. This is as expected: distances of more than 1 to 1.5 km are too large for young children to cross, especially on foot. This means that, in the context of the pandemic, as during normal times, large home-school distances present a great barrier to AST.

Household’s income and mother’s flexibility at work are other factors that have affected children’s travel modes - both before the pandemic and after schools reopened. Mothers who do not need to adhere to rigid work schedules (e.g., because they telecommute or are unemployed) are more likely to escort their children to school by car or motorcycle, as they have more time to do so. As elsewhere (see Motte-Baumvol et al., 2017), chauffeuring children (and childcare more generally) is mainly a mother’s task in Hanoi (Knodel et al., 2005). Compared to fathers, mothers are more likely to believe that the risk of community infection is still high in Hanoi; hence they may be more protective of children than fathers. A similar finding is reported by Aibar Solana et al. (2018). In lower-income families, mothers are more likely to be unemployed or employed only part-time, and some may have lost their jobs during the pandemic. Therefore, they have more time to take their children to school by motorcycle. This explains the finding that children from households earning $1000–1500 / month were less likely to have shifted to motorized transport than peers from households with a monthly income under $650.

With regard to location, the model reveals that children attending schools in urban districts were more likely to shift away from AST than those attending schools in non-urban districts. This appears counterintuitive. It may be that, higher population densities in Hanoi’s urban districts are seen as exposing pedestrians and cyclists to a higher risk of infection. Furthermore, urban parents may have more access to mass media and the internet and therefore be more informed about the Covid-19 spreading patterns. Notably, during school closures, most Covid-19

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5. Many adults cycle too, but they do so for recreation rather than utilitarian transport.

6. The mean level of agreement with statement ‘the risk of community infection is still high’ was 3.5 for fathers and for 3.9 for mothers. An ANOVA test (p = 0.000) showed that the difference is statistically significant.
hotspots in Hanoi were in urban districts, such as the Bach Mai hospital;

### Table 2
Factors associated with shifting modal patterns.

| Variables                      | Regression analysis 1 | Regression analysis 2 |
|--------------------------------|-----------------------|-----------------------|
|                                | Shift from AST to motorized transport | AST after school reopening |
|                                | Coef. | SE      | P > | z | Coef. | SE      | P > | z |
| Age                            | 0.275 | 0.063  | 0.000 |       |       |       |       |       |
| Bus use (ref – no)             | 3.102 | 0.541  | 0.000 |       |       |       |       |       |
| Car ownership (ref – 0)        |       |       |       |       |       |       |       |       |
| 1 car                          | 0.094 | 0.564  | 0.868 | –0.717 | 0.302  | 0.018 |       |       |
| ≥2 cars                        | 3.034 | 1.136  | 0.008 | –1.743 | 0.586  | 0.003 |       |       |
| Motorcycle ownership (ref – 1 or 0) | 1.661 | 0.578  | 0.004 | –1.061 | 0.333  | 0.001 |       |       |
| Bicycle ownership (ref – zero) | –0.835 | 0.424  | 0.039 | 0.905  | 0.264  | 0.001 |       |       |
| Monthly income (ref – under 650 US$) |       |       |       |       |       |       |       |       |
| 650–under 1000 US$             | 0.247 | 0.492  | 0.616 |       |       |       |       |       |
| 1000–under 1500 US$            | –1.162 | 0.579  | 0.045 |       |       |       |       |       |
| ≥1500 US$                      | –0.842 | 0.763  | 0.270 |       |       |       |       |       |
| Mother’s work flexibility** (ref – fixed time and fixed workplace) |       |       |       |       |       |       |       |       |
| Fixed time and flexible workplace | 4.015 | 0.857  | 0.000 | –1.674 | 0.450  | 0.000 |       |       |
| Flexible time and fixed workplace | 1.502 | 0.517  | 0.004 | –0.900 | 0.344  | 0.009 |       |       |
| Flexible time and flexible workplace / unemployed | 1.707 | 0.532  | 0.001 | –0.916 | 0.310  | 0.003 |       |       |
| School location (ref – non-urban) | 1.741 | 0.444  | 0.000 | –0.966 | 0.265  | 0.000 |       |       |
| Home-school distance (ref – over 1.5 km) |       |       |       |       |       |       |       |       |
| <1 km                          | –3.950 | 0.687  | 0.000 | 2.940  | 0.395  | 0.000 |       |       |
| 1–1.5 km                       | –3.202 | 0.557  | 0.000 | 1.437  | 0.290  | 0.000 |       |       |
| Child might forget wearing mask to school | 0.409 | 0.206  | 0.047 |       |       |       |       |       |
| Risk of community infection is still high | 0.532 | 0.201  | 0.008 | –0.267 | 0.133  | 0.044 |       |       |
| Constant                       | –5.104 | 1.356  | 0.000 | –2.509 | 1.029  | 0.015 |       |       |
| Log likelihood                 | –101.0839 | 228.9690  | 0.842 | 0.000 |       |       |       |       |
| Pseudo R²                      | 0.4131 | 0.2390 |       |       |       |       |       |       |
| Number of observations         | 252 (AST portion before school closures) | 472 (full sample) |       |       |       |       |       |       |
| Dependent variable values      | “Shift from AST to motorized transport” = 1; otherwise = 0 | “AST after school reopening” = 1; otherwise = 0 |       |       |       |       |       |

Only significant variables are presented in this table. This p-value is significant but rather close to the cutoff (0.05).

** Authors tested father’s education, workplace and work flexibility but these variables were not significant.

reach the bus stop on foot. The link between public transport ridership and walking is often overlooked in studies on the school commute, although we know that walking is the most common mode for the first/last mile of a trip (Besser and Dannenberg, 2005; Nguyen and Armoo-gum, 2021b).

Where cars or motorcycles are available in the home, children are less likely to engage in AST. This finding corroborates a previously documented (inverse) relationship between motorization and AST (Carver et al., 2019; Pojani and Boussauw, 2014; Waygood and Susilo, 2015). Meanwhile, bicycle ownership is positively linked to AST (cycling specifically). This is consistent with the observation that bicycles in Hanoi are mainly used by children for the school commute (Hansen, 2017). In some other countries, cycling is common among both adults and children for both utilitarian and recreational travel; in those countries, having a bicycle in the home does not necessarily mean that children will use it to cycle to school (see, for example, Carver et al., 2019).

Short home-school distances (less than 1.5 km) lead to more AST in Hanoi. This specific threshold has also been reported in studies based in Ghana (Siiba, 2020), Wales (Potoglou and Arslanguova, 2017), and the US (McDonald, 2008). Interestingly, the Hanoi threshold is much lower than the 2.5 km threshold reported for Ho Chi Minh City in 2009 (Trang et al., 2012). It may be that, in larger cities children and their parents are willing to cross longer distances on foot or by bicycle. Or, it may simply be that home-school distances which children and parents will tolerate before they shift from AST to motorized transport are decreasing over time in Vietnam.

Again, mothers with more time available tend to escort children to school, and due to inadequate active transport infrastructure in Hanoi, the escorting is more often done by car or motorcycle rather than by bicycle or on foot. Once schools reopened, parental concerns around children wearing masks regularly ceased to have a statistically significant effect on AST. However, fear of community infections still has a negative effect on the odds of a child being allowed to walk or cycle to school.

Children attending school in urban districts are less likely to commute actively compared to those studying in the broader metropolitan region. This result is counterintuitive given that home-school distances are shorter in the city. Also, the result contrasts with the findings of Potoglou and Arslanguova (2017) and Siiba (2020). We assume that it is due to poorer facilities for walking and cycling, and heavier and chaotic motorized traffic in the inner city (Nguyen et al., 2019). These force parents give their children a lift to school. Also, incomes are higher in urban districts, which translates into higher levels of car and motorcycle ownership. Children in non-urban districts usually walk to school (10%) alone or accompanied by classmates or related adults - or, more likely given distances, they cycle (21%).

### 5. Conclusion

The Covid-19 pandemic has been quite detrimental in terms of transport sustainability. This study found that, once schools reopened after the first lockdown in Hanoi (in May 2020), the prevalence of AST decreased by more than 23%; from 53% to less than 31%. A key finding is that, where parents, especially mothers, did not face barriers to motorized travel (such as not owning a car or motorcycle, or being overworked), they prohibited children from walking or cycling to school and assumed the role of chauffeur. Parents who were more concerned about community infections and about children forgetting to use masks on the way to school were more motivated to shift children to motorized modes. Walking was more affected than cycling because it was seen as more likely to lead to physical contact and virus transmission. AST dropped more steeply in urban districts (as opposed to poorer, non-urban districts) and in those areas where home-school distances were the largest. It appears that the most common perceptions around barriers to AST have been exacerbated during the pandemic as parents and
childen adapt to “the new normal”. While the picture is rather dire at the moment, some recommendations follow on how to revive AST - in Hanoi and elsewhere in the Global South.

Policies, tools, and programs that limit car and motorcycle ownership and use are key. So are investments in active transport infrastructure (Pojani and Stead, 2015), focused on a 1.5 km radius around schools (the AST threshold identified in this study). School bus services, which now serve a minuscule percentage of the pupil population due to cost, need to be expanded and upgraded. Rather than arranged ad hoc by parents and teachers, school bus services could be provided by large public transport operators (such as Transerco in Hanoi) and have dedicated vehicles, fixed routes, and subsidized tickets. Pedestrian routes to bus stops need to be upgraded too, as children tend to reach stops on foot. Given that cycling to school did not decline as much as walking, improving access to bicycles may be a way to boost levels of AST. This can be achieved by subsidizing the cost of bicycle purchases for lower-income families or by installing bikesharing stations in the vicinity of schools.

This study is not free of limitations. The key issue is the survey bias toward higher-income, car-owning households. Also, the findings reported in this study cover the short term effects of the pandemic on AST. The question remains of how AST will be impacted in the long term if the pandemic continues for an extended period. As the world is experiencing a climate emergency in addition to a public health crisis, this question is crucial. To answer it, studies similar to ours, possibly controlling for more variables, will need to be conducted periodically in different settings around the world.

Declaration of Competing Interest

The authors confirm that there is no conflict of interest regarding the publication of this paper.

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