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Covid-19 need not spell the death of public transport: Learning from Hanoi’s safety measures

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ABSTRACT

Objectives: In contrast to other cities worldwide, the pandemic has not decimated bus ridership in Hanoi. Notably, the Vietnamese capital has mostly relied on the use of face masks and hand sanitizer during travel, instead of requiring physical distancing on buses. This study examines public bus passengers’ levels of compliance with Covid-19 safety measures, and the factors that affect compliance.

Methods: Face-to-face surveys were administered between 7 September and 3 October 2020, right after the end of the third wave of Covid-19 in Hanoi on 51 bus routes. Exploratory Factor Analysis was carried out to extract factors from attitudinal statements. The extracted factors, passengers’ socio-demographic traits, and their bus use patterns were modelled to determine which variables lead to more compliance with Covid-19 safety measures.

Results: We found that 100% of passengers wore face masks (which were mandated), albeit 11% did so incorrectly, while only 28% of passengers used the hand sanitizer provided by bus operators (which was recommended but not required). In addition, 38% of passengers carried their own bottles of hand sanitizer while travelling, despite a relatively low risk of contracting the virus. Women, older passengers, and urbanites were less likely to sanitise their hands. Frequent bus travellers behaved like the population at large with regard to protective measures against Covid-19.

Conclusions: Hanoi’s overall measures - full use of face masks and partial use of hand sanitizer - were sufficient to contain three relatively minor Covid-19 waves while still maintaining regular bus operations most of the time. If other cities were able to reach these levels of compliance, most would be in much better position vis-à-vis public transport use during the pandemic (or an epidemic). Our findings suggest that mandates work much better than awareness raising campaigns, although the latter have a role to play.

1. Introduction

While mobility is vital to the well-functioning of cities and counties, travel can also act as a major spreader of disease (De Vos, 2020; Musselwhite et al., 2020; Rocklöv et al., 2020; Shen et al., 2020; Zhao et al., 2020; Zheng et al., 2020). Mobility restrictions, cancellations of major public events, and mass adoption of telecommuting led to a dramatic drop in travel demand during the Covid-19 pandemic, especially in the first stages. For example, in the Netherlands, the number of all trips decreased by more than half in 2020,
and the travelled distances contracted considerably (de Haas et al., 2020). Budapest also experienced a decrease in mobility by about half (Bucsky, 2020).

But a reduced travel demand impacted transport modes differently: individual modes (cars and micromobility) which limit contact with others were preferred over collective modes (buses and trains). For example, over the course of 2020, the share of driving in Budapest increased from 43% to 65% (Bucsky, 2020). In post-lockdown Australian cities, driving levels exceeded pre-pandemic levels (Sipe, 2020). In South Korea, car sales in March–April 2020 were higher than during the same period of the previous year (Sung and Monschauer, 2020). Similar growth rates were reported for cycling, scooter use, bicycle purchases, and bikesharing around the world (Sung and Monschauer, 2020; Teixeira and Lopes, 2020).

In contrast, public transport ridership declined. For example, in the three most populated regions of Sweden, the decline was in the range of 40%–60% (Jenelius and Cebečauer 2020). In Budapest, the public transport mode share fell from 43% to a meagre 18% (Bucsky, 2020). In Spain, transit use at the end of June 2020 had declined by 40% compared to June 2019 (Orro et al., 2020). In Australia’s largest cities, bus, tram, and train ridership declined by 80–89% (Sipe, 2020). The concern is that these changes will be long-lasting (de Haas et al., 2020). Early research results in China and the Netherlands suggest that more people intend to drive in the future than before the pandemic (de Haas et al., 2020; Li et al., 2020).

Widespread public fears around public transport use are understandable. The virus that causes Covid-19 (SARS-CoV-2) spreads via droplets while talking, coughing, and sneezing, and exposure is higher in enclosed, potentially crowded environments such as a bus or a train car (De Vos, 2020; Funk et al., 2010; Guellich et al., 2021; Shen et al., 2020). Moreover, the virus can survive for long periods of time depending on the surface material: up to 4 h on copper, up to 9 h on human skin, up to 24 h on cardboard, and up to several days on plastic or steel (van Doremalen et al., 2020; Hirose et al., 2020). New virus mutations are more infectious than earlier variants. Therefore, even buses or trains that are sanitized on a daily basis pose a risk of transmission.

Yet, public transport is vital to cities (Nguyen-Phuc et al., 2020; Pojani and Stead, 2015) and its preservation in a post-pandemic world is essential. For safety, a series of non-pharmaceutical measures must be widely adopted while on board and at stops, including: (1) adoption of physical distancing (2) wearing of face masks, and (3) sanitising hands (Tirachini and Cats, 2020). Ideally, these measures should be used in combination rather than in isolation, but some have been more controversial than others.

Throughout 2020, a number of cities established ‘safe distance’ thresholds for their public transport systems. These ranged from 1 m in Milan to 6 feet (1.8 m) in New York (World Bank, 2020). As a result of these rules, in Shenzhen and Madrid, public transport had to operate at less than half and less than a quarter of the normal capacity respectively (World Bank, 2020). In Nigeria, a row of five seats could not carry no more than three passengers at a time (Dzisi and Dei, 2020). Cities were willing to apply distancing rules although they reduced the carrying capacity of vehicles, thus increasing operating costs and undermining the service frequency (Tirachini and Cats, 2020).

Wearing face masks in public spaces met with more resistance compared to the other measures. The World Health Organization itself caused some confusion at the outset by recommending the use of masks for symptomatic individuals only (Tirachini and Cats, 2020). Later, as it became clear that in over half of the cases patients were asymptomatic or only presented mild symptoms (Wang et al., 2020), many countries, in particular in East Asia, mandated the use of masks (surgical or fabric) at all times while outdoors. This helped places such as China, Singapore, Taiwan, Hong Kong, and South Korea, to control the pandemic rather effectively (Prather et al., 2020). In other countries, where masks are only recommended but not required, use remained low. For example, in Ghana, fewer than 13% of public transport riders used face masks (Dzisi and Dei, 2020).

So far, very little is known on the usage rates of hand sanitizer in public transport systems. Anecdotally, the use of hand sanitizer appeared to be common where this was provided for free at stations, stop, or aboard vehicles. However, alcohol-based sanitizers can be hazardous (Mahmood et al., 2020), thereby leading many passengers to avoid them. A Paris-based study showed that barely 8% of respondents used alcohol-based hand sanitizer on board (Guellich et al., 2021).

In this study set in Hanoi in 2020, we examine passengers’ levels of compliance with safety measures aboard public buses, and the factors that affect compliance. We also provide suggestions on how to improve compliance. Hanoi, a megacity of more than 8 million, was selected as a case study because it is considered as a success story in terms of Covid-19 containment (CNN, 2020). Unlike previous studies that relied on third party data, such as mobile phone and subscription card data (Orro et al., 2020; Sipe, 2020; Teixeira and Lopes, 2020), this study of Hanoi employed original surveys of bus users. By way of context, in Hanoi face masks must be worn in public spaces (including buses) at all times and bus passengers are expected to follow other rules and guidelines. Physical distancing is not required aboard buses but hand sanitising is encouraged and sanitizer bottles are provided on board.

Owing to these measures, bus ridership was not decimated in Hanoi, and by the end of 2020 it was already poised to return to pre-pandemic levels (see Table 1). The findings in Hanoi can help planners and public health officials draw lessons for other cities that are still struggling with the pandemic. Beyond Covid-19, Hanoi’s approach can help contain more local epidemics. We must note, however, that Covid-19 infections rates and deaths have been much lower in Vietnam than elsewhere (fewer than 20,000 cases and fewer than 100 deaths in total as of July 2021).

2. Background on Hanoi’s public transport system

Before proceeding to the empirical portion of the study, we discuss Hanoi’s public transport supply and demand before the Covid-

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1 Since the turn of the millennium, diseases such as SARS, MERS, Ebola, HSN1 have posed a major risk at the global level, although they were eventually contained.
passengers, expansion plans have been scrapped (Nguyen et al., 2019a, 2020a; Nguyen and Pojani, 2018). Currently, the BRT line is managed by a state-owned company, Transerco, along with the conventional bus network. A pilot of the first metro line (connecting Ha Dong and Cat Linh) was launched in 2018 but the timeline for launching commercial operations has not been announced, as major safety concerns have been raised. The second line, running from Hang Co to Nhon, is still under construction. The metro lines are cheaper than the motorcycle.

In conjunction, the city invested in new and modern vehicles and expanded the route network (from 31 in 2000 to 104 by 2019). In 2001, the various bus companies were merged into a single state-owned enterprise (Transerco) to facilitate service integration. A promotional campaign was also launched, the motto being "the bus is faster than the bicycle and cheaper than the motorcycle." This major reform became a national model for public transport development and led to substantial growth in bus ridership (Fig. 1).

A new BRT line was created in 2017, with support from the World Bank. While this has shortened travel times for people living and working in proximity to stations (Hoang-Tung et al., 2020), overall it has underperformed. With a daily ridership of only about 14,500 passengers, expansion plans have been scrapped (Nguyen et al., 2019a, 2020a; Nguyen and Pojani, 2018). Currently, the BRT line is managed by a state-owned company, Transerco, along with the conventional bus network. A pilot of the first metro line (connecting Ha Dong and Cat Linh) was launched in 2018 but the timeline for launching commercial operations has not been announced, as major safety concerns have been raised. The second line, running from Hang Co to Nhon, is still under construction. The metro lines are cheaper than the motorcycle.

This is the context in which the Covid-19 pandemic hit.

2.2. Response to the Covid-19 pandemic and impact on public transport

In 2020, Vietnam experienced three waves of Covid-19, delineated below. Bus ridership data along the progression of the pandemic are reported in Table 1.

| Month (2020) | Bus ridership (million) | Bus operation | Covid-19 timeline |
|--------------|-------------------------|---------------|-------------------|
| Jan          | 27.1                    | Normal operation; New Lunar Year holiday | Wave 1 |
| Feb          | 19.2                    | Schools and universities closed | Wave 2 |
| Mar          | 15.6                    | Schools and universities closed | No community transmission |
| Apr          | 0.63                    | Nationwide physical distancing required | |
| May          | 19.2                    | Physical distancing requirements lifted & universities re-open | |
| Jun          | 21.9                    | Normal operation | |
| Jul          | 20.9                    | Normal operation | Wave 3 |
| Aug          | 15.2                    | Normal operation | |
| Sep          | 20.8                    | Normal operation | |
| Oct          | 25.3                    | Normal operation | |

In Hanoi, motorcycles are the dominant transport mode whereas public transport and bicycle use is relatively low (Nguyen and Armoogum, 2020; Nguyen and Pojani, 2018; Tuan and Mateo-Babiano, 2013). The government has enabled automobility by investing in road infrastructure more than in public transport and by applying few controls on car ownership and use. Only 8% of trips take place on public transport (TRAMOC, 2019), which comprises conventional buses and a BRT line. However, in a megacity, this still translates into millions of monthly bus trips, and, given current levels or congestion and pollution, it would be disastrous if most of those trips were converted to car or even motorcycle trips (OECD, 2018; Nguyen et al., 2019b; Nguyen-Phuoc et al., 2019). Meanwhile, Hanoi’s public transport system has experienced many ups and downs along its hundred-year long history. Up until the 1980s, the city had five tramway lines and one trolleybus line. Most were inherited from the French colonial period, and a few were built by the communist government. All of these were dismantled in the 1990s due to safety concerns and low commercial speeds.

The 17th positive case (the first one in Hanoi) was recorded on 6 March. This marked the beginning of the second wave. The number of cases snowballed thereafter, and Bach Mai, one of the largest hospitals in Hanoi, became an epicentre of the disease. Many province leaders urged the prime minister to issue strict directives. On 1 April, the government mandated nationwide...
lockdowns (Nguyen, 2021). People at high risk of spreading the virus were moved to hospitals or quarantine centres. Going out was allowed only for absolute necessities such as food shopping. Physical distancing requirements (2 m) applied while outdoors, and masks had to be worn. All gatherings were prohibited, and all but essential services (grocery stores, pharmacies, and fuel stations) were shut. Regular hand washing was highly recommended. A recent survey of 2175 people spread around Vietnam found that compliance with safety measures was high, especially in locations that had more confirmed cases (Nguyen et al., 2020b). A full 99.5% of survey respondents wore masks when going out. In this manner, the second wave was successfully contained too. By the second half of April, community transmissions completely halted. Therefore, physical distancing requirements were lifted at the end of April. In Hanoi, public buses discontinued operations between 28 March and 23 April. Then, between 24 April and 5 May, the buses operated at 20–30% of the normal frequency. No more than 30 people were allowed on board at one time, including the driver and the conductor, and the distance between passengers had to be at least 1 m. Chatting and eating on board were limited while air-conditioning was turned off. On May 7, the physical distancing requirement on buses was lifted. However, passengers were encouraged to clean their hands with sanitizer containing at least 60% alcohol when boarding a bus (Ministry of Health, 2020). Bottles of sanitizer were provided on the vehicles.

Third wave. On 26 July, after 99 continuous days of no community transmissions, a new case was detected in a Da Nang hospital. This led to a new breakout, which resulted in the first Covid-19 death in Vietnam, on 31 July. Several districts, including some in Da Nang, went back into strict lockdown. This way, the third wave was abated by 2 September. No new cases have been recorded since. In Hanoi which was much less infected, the preventive measures were less strict in this round. However, the local government sent out regular reminders regarding the obligatory use of masks while outdoors and the benefits of frequent hand washing and sanitising. Bus services continued their normal operations, without physical distancing on board. Ridership experienced a dip in August but recovered in September and grew further in October (see Table 1).3

3. Methodology

The data collection and analysis procedures are delineated below.

3.1. Data collection

To examine bus passengers’ compliance with Covid-19 safety measures, we conducted a survey of bus users. The survey was administered between 7 September and 3 October 2020, right after the end of the third wave (Fig. 2). The questionnaires were administered in face-to-face interviews. The passengers of 51 bus routes were approached with a request to complete a survey. Two to

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2 On 30 April 2020 in Hanoi but a week earlier in lower risk areas.
3 Before this article went to press, Hanoi experienced another Covid-19 wave in May-September 2021 with the 2nd lockdown mandated.
three surveyors (wearing protective equipment, such as masks and gloves) rode on each bus to collect the surveys. Of the routes selected for inclusion (nearly half of all Hanoi routes), 24 operated within the urban area only, 25 operated across the urban and metropolitan areas, and 2 covered the outer region only (Fig. 3). This sample distribution was compatible with the overall distribution of bus routes in Hanoi. To achieve temporal representation, surveys were conducted both on weekdays and at weekends.

The survey had four portions. In the first portion, we collected information on bus use habits and the use of hand sanitizer while on board. The second portion comprised attitudinal statements (ranked on a five-point Likert scale) about using hand sanitizer and face masks, the pandemic more generally, and concerns around bus travel (e.g., pickpocketing). Three items designed to measure the fear of Covid-19 infection were adapted from Ahorsu et al. (2020) and Nguyen and Armoogum (2021). Three items measured the quality and availability of hand sanitizer (Selam, 2020). Two items were included to account for the possibility that passengers do not use sanitizer due to distraction by other concerns such as pickpocketing (Ding and Zhai, 2021) or finding a seat (Alam and Werth, 2008). A final item asked whether passengers believed that the use of face masks reduced the need to use hand sanitizer. This was based on the cognitive stress theory, according to which, during stressful situations people tend to adopt coping strategies selectively rather than comprehensively (Homburg and Stolberg, 2006; Lazarus, 1994). In an open-ended question, respondents were asked to provide any suggestions for increasing compliance with safety measures on buses.

In the third portion of the questionnaire, we collected demographic data (age, gender, occupation, residential location, educational level, and existing health issues). The final portion of the survey form contained the surveyor’s observations. It recorded observations on the number of hand sanitizer bottles on board and whether the respondent (bus passenger) was wearing the face mask incorrectly (i.e., the mask was not covering the person’s mouth or nose or was being worn upside down).

An additional 6% of people who initially agreed to participate were excluded from the survey as they reported being allergic to hand sanitizer. After removing incomplete questionnaires (32), the final sample resulted in 570 responses eligible for quantitative analysis. Only 243 respondents (43% of the total) answered the open-ended question, and those responses were treated as qualitative data.

3.2. Analytical procedure

All the statistical analyses were conducted in Stata 15.0. First, descriptive statistics of the data were computed. Then, the attitudinal statements were reduced through exploratory factor analysis. We employed principal component analysis (eigenvalue>1, Oblimin rotation method with Kaiser normalization). Finally, two logit models were estimated:

Model 1, a binary logit model, was applied to the entire sample to determine whether a passenger used hand sanitizer on board and why. The independent variables included gender, age, occupation, education, living area, bus use frequency, ticket type, carrying of heavy luggage, carrying of personal hand sanitizer, proper use of face mask, existing health issues, number of sanitizer bottles on board, and factors extracted from attitudinal items.

Model 2, an ordered logit model, measured the frequency of using hand sanitizer on board. This model was applied to a subsample of passengers travelling by bus at least twice per week (345 respondents or 60% of the total). The list of independent variables included: gender, age, occupation, education, residential location, ticket type, carrying of personal hand sanitizer, existing health issues, and factors extracted from attitudinal items. The findings from the descriptive statistics, the exploratory factor analysis, and the two models are discussed below.

4. Findings and discussion

4.1. A broad overview: descriptive statistics and data reduction

Table 2 shows the descriptive statistics for the full sample and the subsample of frequent bus users. The overall response rate was very high, at 90%, as noted. In both samples, the gender distribution was balanced. The vast majority of bus passengers was under 30, suggesting high bus use among students, as expected. This also explains why most passengers did not have a university degree (yet). A cluster of users comprised older people, many on lower incomes. People living close to the city centre were much more likely to be bus users. Slightly more than half of all passengers used monthly subscriptions, while only 6% benefited from concessions. Among frequent users, over three fourths had monthly subscriptions while the rate of concessions was the same as for the entire sample. Many passengers (11%) carried heavy luggage during their bus trip. The overwhelming majority did not report any health issues (that would place them at higher risk in case they contract Covid-19).

All respondents wore masks while on the bus. However, masks were incorrectly used in 11% of cases. At least one bottle of hand sanitizer was provided in all the surveyed buses (usually two bottles). Yet, only 28% of respondents used hand sanitizer on board – although very few reported having an adverse reaction to alcohol-based hand sanitisers. Among frequent bus users, only a fifth reported using hand sanitizer regularly.

However, many passengers (38%–43%) carried personal hand sanitizer bottles. Also, many were quite scared of the prospect of contracting Covid-19, and believed that masks alone were insufficient to protect against infection (Table 3). The responses to

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4 Free tickets for passengers over 60.
attitudinal questions suggested that a low rate of hand sanitising may be partly due to too few bottles being provided for free on buses and those being nearly empty most of the time. Some people believed that free sanitizer is of low quality and therefore useless. Another portion of passengers shunned hand sanitising because they were preoccupied with finding a seat or comfortable standing spot when boarding a bus, or they were worried that they might fall prey to pickpocketing if they were distracted even momentarily.

Upon analysing the suggested solutions to improve ‘health and safety’ on buses. All the suggestions were first summarized and then grouped based on similarity of content. This process produced nine groups, of which the top five had the highest frequencies by far (Table 4). Most respondents requested that more sanitizer be offered on buses but only 13% believed that hand sanitising should be obligatory for bus passengers. No objections were raised about the requirement to use masks while riding buses.

The data collected through attitudinal questions were reduced into four factors (types of perceptions): (1) The pandemic is scary; (2) The sanitizer on-board is no good; (3) Bus travel can be un-comfortable; and (4) Masks are sufficiently protective (Table 5). These four factors were then used in the modelling exercises discussed below.

4.2. Modelling results: who uses protective measures, how often, and why?

The results of Model 1 are presented in Table 6. We focused on the use of hand sanitizer given that masks were universally worn whereas physical distancing requirements have been lifted, as noted. Our analysis showed that women were less likely to use hand sanitizer on buses compared to men. This was rather surprising given that women are generally more risk averse and more likely to comply with public health measures – as found in studies based in Japan and Switzerland (Machida et al., 2020; Nivette et al., 2021).

Similarly, older passengers (over 45) were less likely to use the hand sanitizer provided on the bus compared to people under 30. The relationship was statistically significant albeit weak. Again, this was counterintuitive given that Covid-19 is known to pose a higher risk among older people (CDC, 2020). In fact, having health issues increased the likelihood of using hand sanitizer. In the case of very old people, perhaps fear of walking around a moving bus to reach a hand sanitizer bottle led to low use. Where buses offered more bottles, the rates of usage went up. But more needs to be done - for example, conductors could be instructed to help older passengers by spray sanitizer on their hands.

Residential location was also influential in the choice of using hand sanitizer with passengers from rural areas being more inclined to sanitise their hands compared to urbanites. This result is incompatible with the finding of Nguyen et al. (2020b) that urban residents in Vietnam are more likely to adhere to preventive measures. On the face of it, it was also surprising given that most confirmed cases have been concentrated in cities rather than villages.

Possibly, there is a common explanation for these findings. It may be that women, urbanites, and older people were better informed on disease risks and, therefore, did not rely on the sanitizer which is freely provided on buses but rather carried their own, higher quality one, so as to be more protected. Unsurprisingly, carrying a personal sanitizer bottle was negatively associated with the likelihood of using the sanitizer provided on board. Notably, there was a positive association between incorrect use of masks and avoidance of the sanitizer provided on board. This relationship seemed to highlight the presence of a small, risk-tolerant cluster of passengers who underestimated the role of protective measures in public places.

With regard to attitudes, a perception that the pandemic is a scary event was not a predictor of sanitizer usage. This suggested that hand sanitising was not regarded as a strong preventive measure – certainly not relative to wearing face masks. This is problematic because both measures are important, and the role of hand sanitising cannot be underestimated. Those passengers who thought that
the freely provided sanitizer is of low quality tended to avoid it. And those who were more concerned with comfort and safety (from crime) on buses were too distracted to use the sanitizer.

In Model 2, once again we focused on the frequency of using hand sanitizer. The results, presented in Table 7, were quite similar to those obtained in Model 1. This means that frequent bus travellers behaved like the population at large with regard to protective measures against Covid-19. Of particular concern is the fact that travellers who believed that masks provided sufficient protection were less likely to use hand sanitizer. This misconception needs to be corrected. One small difference between the two models was that the relationship between hand sanitizer use and Factor 3 (‘Bus travel can be uncomfortable’) was weaker. It might be that frequent passengers were more familiar with buses and, therefore, had developed strategies to ensure their safety and comfort during travel.

5. Conclusion and policy implications

While the Covid-19 pandemic has undermined bus transport worldwide, Hanoi has been able to sustain ridership levels (notwithstanding temporary dips in April–March and August 2020). Notably, the Vietnamese capital has mostly relied on the use of face masks and hand sanitizer during travel, instead of requiring physical distancing on buses. This study revealed that 100% of passengers wore face masks (which were mandated), albeit 11% did so incorrectly, while only 28% of passengers used the hand

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5 A note on multicollinearity. This can produce unstable p-values, thus confounding influential factors. Therefore, after the logit models were estimated, the variance inflation factors (VIFs) of independent variables were computed to diagnose multicollinearity. For all independent variables, the VIFs were smaller than 4, meaning no risk of multicollinearity (O'Brien, 2007). For the ordered logit model, the Brant test showed that the parallel regression assumption was not violated.
In combination, Hanoi’s measures - full use of face masks and partial use of hand sanitizer - were sufficient to contain three (relatively minor) Covid-19 waves while maintaining regular bus operations most of the time. If all other cities were able to reach these levels of compliance, most would be in much better position vis-à-vis public transport use during the pandemic. Our findings suggest that mandates work much better than awareness-raising campaigns (even in collectivist cultures like Vietnam’s), although the latter have a role to play.

Even where certain safety measures are mandated, conductors (ticket collectors) need to be more vigilant and direct passengers to use masks correctly and apply hand sanitizer. They also need to assist the older adults, people with disabilities, pregnant women, and those carrying heavy luggage. Moreover, conductors (and operators in general) need to work on addressing longstanding issues such as pickpocketing, sexual harassment, or abuse of reserved seats on buses, so that passengers are not too preoccupied with those to forget sanitising their hands and fixing their masks.

This is one of the first studies to examine compliance with non-pharmaceutical Covid-19 safety measures (the wearing of masks and hand sanitizer provided by bus operators (which was recommended but not required). In addition, some passengers (38%) carried their own bottles of hand sanitizer while travelling. The results suggested that, had more and better hand sanitizer been provided on buses, more people would have used it. (We recommend providing one full bottle per bus door; we also recommend that bottles display labels with the effectiveness rate of the product.)

### Table 2
Descriptive statistics.

| Variables                              | Values                                      | Sample 1: All respondents (N=570) | Sample 2: Frequent passengers only (N=345) |
|----------------------------------------|---------------------------------------------|-----------------------------------|--------------------------------------------|
| Gender                                 | Male                                        | 280 49                           | 167 48                                     |
|                                        | Female                                       | 290 51                           | 178 52                                     |
| Age                                    | <30                                          | 426 75                           | 282 82                                     |
|                                        | 30–45                                        | 58 10                            | 32 9                                       |
|                                        | ≥45                                          | 86 15                            | 31 9                                       |
| Occupation                             | Students/pupils                               | 368 65                           | 241 70                                     |
|                                        | Employed or self-employed                     | 104 18                           | 59 17                                      |
|                                        | Other                                         | 98 17                            | 45 13                                      |
| Education                              | University degree or higher                   | 185 32                           | 79 23                                      |
|                                        | No university degree                          | 385 68                           | 266 77                                     |
| Residential location                   | Urban area                                    | 398 70                           | 248 72                                     |
|                                        | Non-urban area                                | 145 25                           | 85 25                                      |
|                                        | Outside Hanoi                                 | 27 5                             | 12 3                                       |
| Bus use frequency                      | Regular (≥ 4 days/week)                       | 202 35                           | 202 59                                     |
|                                        | Frequent (2–3 days/week)                      | 143 25                           | 143 41                                     |
|                                        | Sometimes (2–4 times/month)                   | 117 21                           | - -                                        |
|                                        | Rarely (2–4 times/year) or first time         | 108 19                           | - -                                        |
| Ticket type                            | Single ticket                                 | 220 39                           | 56 16                                      |
|                                        | Monthly subscription                          | 314 55                           | 267 77                                     |
|                                        | Concession                                    | 36 6                             | 22 6                                       |
| Carries heavy luggage†                 | Yes                                          | 61 11                            | - -                                        |
|                                        | No                                           | 509 89                           | - -                                        |
| Carries personal hand sanitizer bottle | Yes                                          | 218 38                           | 149 43                                     |
|                                        | No                                           | 352 62                           | 196 57                                     |
| Uses mask correctly                    | Yes                                          | 505 89                           | - -                                        |
|                                        | No                                           | 65 11                            | - -                                        |
| Has health issues                      | Yes                                          | 92 16                            | 63 18                                      |
|                                        | No                                           | 478 84                           | 282 82                                     |
| Number of hand sanitizer bottles on board | 1                                         | 87 15                            | - -                                        |
|                                        | 2                                            | 445 78                           | - -                                        |
|                                        | ≥3                                           | 38 7                             | - -                                        |
| Uses hand sanitizer on board           | Yes                                          | 157 28                           | - -                                        |
|                                        | No                                           | 413 72                           | - -                                        |
| Frequency of using hand sanitizer on board | Always or nearly always                   | - -                              | 69 20                                      |
|                                        | Some of the time                              | - -                              | 157 46                                     |
|                                        | Never or almost never                          | - -                              | 119 34                                     |

Notes:
†Child prams are not included as it is nearly impossible to carry those on Hanoi buses (bus doors are too narrow and buses have steps on board).
the use of hand sanitizer) on a public transport system in a Global South setting. A major strength of the study is its use of primary data in the form of a large and representative sample of bus passengers. By employing face-to-face interview material, rather than relying on observations, the study revealed a wealth of psychological nuances that support or undermine compliance. As for shortcomings, the findings cover the short-term effects of the pandemic on bus travel. Also, the Covid-19 prevalence has been quite low in Hanoi relative to other major cities around the world. The question remains of how public transport 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.

Table 3
Attitudinal variables.

| Attitudinal items                                                                 | Sample 1: All respondents (N=570) | Sample 2: Frequent passengers only (N=345) |
|-----------------------------------------------------------------------------------|-----------------------------------|------------------------------------------|
|                                                                                   | Mean   | SD*  | Mean   | SD*  |
| The hand sanitizer provided on buses is of low quality                            | 2.932  | 0.794| 2.872  | 0.804|
| Sanitizer bottles on buses are usually nearly empty                               | 2.853  | 0.802| 2.846  | 0.819|
| There are too few bottles on buses                                               | 3.214  | 0.881| 3.209  | 0.884|
| Covid-19 is a dangerous disease                                                   | 4.554  | 0.730| 4.557  | 0.772|
| Contracting Covid-19 is serious                                                   | 4.500  | 0.731| 4.501  | 0.767|
| The risk of community infection (in restaurants, markets, buildings) is high     | 4.293  | 0.766| 4.267  | 0.831|
| It is important for me to find a seat or a comfortable standing position when travelling by bus | 3.739  | 0.937| 3.771  | 0.963|
| I am concerned about pickpocketing when boarding buses                           | 4.339  | 0.861| 4.400  | 0.881|
| Using a mask is sufficient protection on buses, I do not need hand sanitizer too | 2.609  | 1.077| 2.577  | 1.060|

Notes:
*SD: standard deviation.

Table 4
Solutions to improve ‘health and safety’ on buses, suggested by passengers.

| Proposed solutions                                                                 | Frequency | %  |
|-----------------------------------------------------------------------------------|-----------|----|
| More hand sanitizer bottles should be provided on buses                            | 182       | 75%|
| Quality of hand sanitizer should be improved                                       | 98        | 40%|
| Passengers should be reminded more often about using sanitizer                     | 65        | 27%|
| Conductors should help passengers when using sanitizer                             | 46        | 20%|
| Sanitising hands aboard should be mandatory like using masks                       | 31        | 13%|

Table 5
Factors extracted through exploratory factor analysis.

| Attitudinal statements (5-point Likert scale) | Factors extracted |
|-----------------------------------------------|-------------------|
|                                               | The pandemic is scary | The sanitizer on-board is no good | Bus travel can be uncomfortable | Masks are sufficiently protective |
| The hand sanitizer provided on buses is of low quality       | 0.6762             |                                  |                                  |                                |
| Sanitizer bottles on buses are usually nearly empty         | 0.8179             |                                  |                                  |                                |
| There are too few bottles on buses                      | 0.7899             |                                  |                                  |                                |
| Covid-19 is a dangerous disease                        | 0.8962             |                                  |                                  |                                |
| Contracting Covid-19 is serious                        | 0.9061             |                                  |                                  |                                |
| The risk of community infection (in restaurants, markets, buildings) is high | 0.8149             |                                  |                                  |                                |
| It is important for me to find a seat or a comfortable standing position when travelling by bus | 0.6292             |                                  |                                  |                                |
| I am concerned about pickpocketing when boarding buses   | 0.8461             |                                  |                                  | 0.9378                         |
| Using a mask is sufficient protection on buses, I do not need hand sanitizer too |                                  |                                  |                                  |                                |

Notes:
Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.686.
Bartlett test of sphericity: chi-square = 1189.345; degrees of freedom: 36; p-value: 0.000; H0: variables are not intercorrelated.
Extraction method: Principal component analysis with eigenvalue>1.
Rotation method: Oblimin with Kaiser normalization.
Score estimation method: regression.
Variation explained by four factors extracted: 0.7082.
Table 6
Results of Model 1 (binary logistic regression).

| Variables | Coefficient | SE | P>|z| |
|-----------|-------------|----|-----|
| Dependent variable | | | |
| Does passenger use hand sanitizer on board? 1 = uses hand sanitizer 0 = does not use hand sanitizer | | | |
| Independent variables | | | |
| Gender (ref = Male) | | | |
| Female | -0.499** | 0.217 | 0.022 |
| Age (ref = Under 30) | | | |
| 30–45 | -0.351 | 0.463 | 0.448 |
| >45 | -1.010* | 0.516 | 0.051 |
| Occupation (ref = Student/pupil) | | | |
| Employed or self-employed | .0773 | 0.367 | 0.833 |
| Other | -0.300 | 0.457 | 0.512 |
| Education (ref = University degree or higher) | | | |
| No university degree | 0.227 | 0.224 | 0.313 |
| Living area (ref = urban area) | | | |
| Non-urban area | 0.482** | 0.245 | 0.049 |
| Outside Hanoi | -0.417 | 0.556 | 0.453 |
| Bus use frequency (ref = Regular, i.e. ≥ 4 days/week) | | | |
| Frequent (2–3 days/week) | -0.442 | 0.289 | 0.126 |
| Sometimes (2–4 times/month) | 0.128 | 0.331 | 0.700 |
| Rarely (2–4 times/year) or first time | 0.147 | 0.388 | 0.705 |
| Ticket type (ref = Single ticket) | | | |
| Monthly subscription | -0.174 | 0.288 | 0.546 |
| Concession | 0.341 | 0.571 | 0.550 |
| Carries heavy luggage on board (ref = Yes) | | | |
| No | 0.113 | 0.384 | 0.769 |
| Carries personal hand sanitizer bottle (ref = No) | | | |
| Yes | -0.457** | 0.222 | 0.040 |
| Uses mask correctly (ref = No) | | | |
| Yes | 1.496** | 0.482 | 0.002 |
| Health issues (ref = Yes) | | | |
| No | -0.721** | 0.286 | 0.012 |
| Number of sanitizer bottles (ref = 3) | | | |
| 1 | -1.351** | 0.471 | 0.004 |
| 2 | -1.913** | 0.419 | 0.000 |
| Factor 1: The pandemic is scary | | | |
| Factor 2: The sanitizer on-board is no good | -0.517** | 0.114 | 0.000 |
| Factor 3: Bus travel can be uncomfortable | -0.237** | 0.105 | 0.024 |
| Factor 4: Masks are sufficiently protective | -0.116 | 0.111 | 0.293 |
| Constant | 0.329 | 0.749 | 0.660 |
| Number of observations (N) | 570 | | |
| Log likelihood | -281.0876 | | |
| LR chi² (23) | 108.82 | | |
| Prob > chi² | 0.0000 | | |
| Pseudo R² | 0.1622 | | |

Notes:
*Statistically significant at the 0.1 level.
**Statistically significant at the 0.05 level.

Author statement

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Declaration of competing interest

None.
Table 7
Results of Model 2 (ordered logistic regression).

| Variables | Coefficient | SE | P>|z| |
|-----------|-------------|----|-----|
| Gender (ref = Male) | | | |
| Female | -0.332 | 0.214 | 0.120 |
| Age (ref = Under 30) | | | |
| 30–45 | 0.550 | 0.453 | 0.226 |
| >45 | 0.827 | 0.521 | 0.112 |
| Occupation (ref = Student/pupil) | | | |
| Employed or self-employed | 0.004 | 0.369 | 0.992 |
| Other | 0.079 | 0.421 | 0.851 |
| Education (ref = University degree or higher) | | | |
| No university degree | -0.036 | 0.220 | 0.871 |
| Residential location (ref = Urban areas) | | | |
| Non-urban areas | 0.516** | 0.238 | 0.030 |
| Ticket type (ref = Single ticket) | | | |
| Monthly subscription | -0.233 | 0.304 | 0.443 |
| Concession | -0.989 | 0.618 | 0.109 |
| Carries personal sanitizer (ref = No) | | | |
| Yes | -0.879** | 0.221 | 0.000 |
| Has health issues (ref = Yes) | | | |
| No | -0.425 | 0.285 | 0.136 |
| Factor 1: The pandemic is scary | -0.013 | 0.099 | 0.895 |
| Factor 2: The sanitizer on-board is no good | -0.227** | 0.108 | 0.035 |
| Factor 3: Bus travel can be uncomfortable | -0.178* | 0.105 | 0.090 |
| Factor 4: Masks are sufficiently protective | -0.227** | 0.112 | 0.043 |
| /cut1 | -1.727 | 0.452 | | |
| /cut2 | 0.540 | 0.442 | | |
| Number of observations | 345 | | |
| Log likelihood | -336.75474 | | |
| LR chi² (15) | 49.14 | | |
| Prob > chi² | 0.0000 | | |
| Pseudo R² | 0.0680 | | |

Notes:
*Statistically significant at the 0.1 level.
**Statistically significant at the 0.05 level.
†Because very few respondents lived in other cities, they were grouped with those living in Hanoi’s metropolitan region.
Brant test results: chi²: -10.63; df: 15; p > chi²: 0.779. A significant test statistic provides evidence that the parallel regression assumption has been violated.

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