WORKING PAPER

ITLS-WP-22-20

Working from Home 22 months on from the beginning of COVID-19: What have we learned for the future provision of transport services?

By
David A. Hensher[a], Matthew J. Beck[b], Camila Balbontin[c,d]

[a,b,c]
Institute of Transport and Logistics Studies (ITLS), The University of Sydney, Australia
[d]
Engineering and Sciences Faculty (FIC) Universidad Adolfo Ibáñez (UAI), Santiago, Chile

October 2022

ISSN 1832-570X

INSTITUTE of TRANSPORT and LOGISTICS STUDIES

The Australian Key Centre in Transport and Logistics Management

The University of Sydney

Established under the Australian Research Council's Key Centre Program.

NUMBER: Working Paper ITLS-WP-22-20

TITLE: Working from home 22 months on from the beginning of the COVID-19: What have we learned for the future provision of transport services?

ABSTRACT:

COVID-19 has delivered an unintended positive consequence through working from home (WFH). While it may be some time until we are able to indicate, with some confidence, the impact that WFH will have on traffic congestion and crowding on public transport, there is a sense already that it is a game changer, and indeed is one of the most effective policy levers that the transport sector has had for many years in 'managing' the performance of the transport network. This paper draws on multiple ways of survey data that have been collected since March 2020 when the pandemic first resulted in severe restrictions in Australia. We present the evidence up to December 2021 on the incidence of WFH and how it has been received by employees and employers from the height of restrictions up to a period when restrictions were relaxed, followed by further lockdowns throughout Australia. We show what this might mean for work productivity, lifestyle, and the changing preferences for passenger modes. With a growing preference, within some occupation classes, to WFH 1 to 2 days a week, and a good spread through the weekdays, we discuss what this means for the way we analyse the impact of transport initiatives on the performance of the transport network with a particular emphasis on the growth in suburbanisation of transport improvements, less costly service and infrastructure improvements, and the changing role of public transport.

KEY WORDS: ***COVID-19; working from home; Australian experience; productivity; strategic models; public transport implications; strategic impacts***

AUTHORS: **Hensher, Beck, Balbontin**

ACKNOWLEDGEMENTS: This research is part of iMOVE Cooperative Research Centre (CRC) research projects 1-031 and 1-034 with Transport and Main Roads, Queensland (TMR), Transport for News South Wales (TfNSW) and WA Department of Transport (WADoT) on Working for Home and Implications for Revision of Metropolitan Strategic Transport Models. The findings reported are those of the authors and are not the positions of TfNSW or TMR; but approval to present these findings is appreciated.

CONTACT: INSTITUTE OF TRANSPORT AND LOGISTICS STUDIES (H04)

The Australian Key Centre in Transport and Logistics Management
The University of Sydney NSW 2006 Australia
Telephone: +612 9114 1813
E-mail: business.itlsinfo@sydney.edu.au
Internet: http://sydney.edu.au/business/itls

DATE: October 2022

1 Introduction

COVID-19 has resulted in a seismic change in the way we all work and travel. A notable change has been remote working away from the main office with much of this occurring from home. Recognising that not all jobs can support working from home (WFH), the ability to do so to some extent is now seen as a legitimate alternative to commuting to the traditional workplace for many workers, with much of the prior stigma evaporating as a result of the relatively productive experience. Since March 2020 when the pandemic took hold and Australia went into lockdown, initially for an unknown period, we recognised a need to start tracking the changes that were expected to unfold as many individuals and households entered an unexplored option to WFH. As a forced measure, it gave us a real-world experiment of the impacts of an extreme event on the way we go about our business and live our lives.

The ongoing journey to track changes in WFH and all of the consequent positive and negative impacts began with a first survey in March/April 2020 and has continued to this day with six surveys undertaken and at least two more planned (see Figure 1). During this 22-month period we have witnessed strict lockdowns, easing of restrictions and the removal of most restrictions. A timeline of events is summarised in the Appendix, noting that there have been significant differences between each State in Australia. The most significant differences relate to a total border closure in Western Australia for most of the time (opening up in March 2022), significant periods of lockdown in Victoria throughout the entire period (Melbourne totalling 263 days, more than any other city globally), and a notable 106-day lockdown in Sydney and the Region of NSW from July to October 2021. These variations have provided a rich opportunity to gain an understanding of the impact of restrictions with different degrees of severity on the propensity to WFH and a range of ancillary impacts such as unexpected positive support from employers to WFH, significant reductions in the use of modes that involve sharing, notably public transport and ride sharing services, with a return to the use of the private car where travel had to take place.

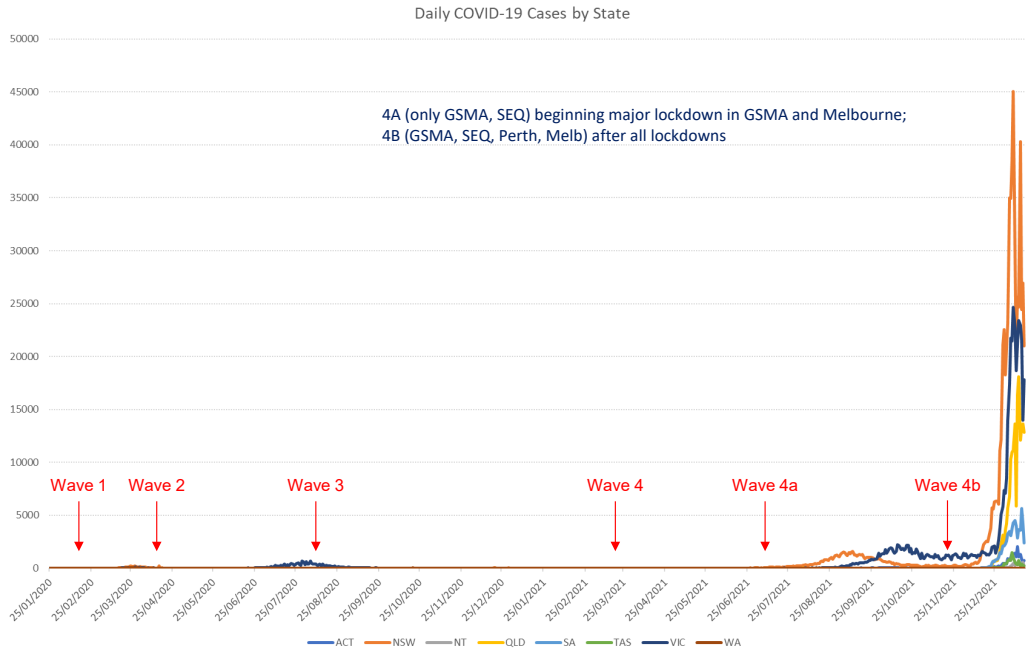


Figure 1. The timeline of surveys to date

With reduced commuting in all jurisdictions accompanied by increased WFH, our interest focussed on what this might mean for future use of all the passenger modes, including active modes of walking and cycling, and whether the accumulating evidence over 22 months signals a 'new normal' as we learn to live with COVID-19 under an increasingly vaccinated population. Our research thus far focusses on three streams: a descriptive overview of what changes are occurring as a result of WFH; a consideration of how the spatial incidence of WFH can be embedded in a new suite of travel choice models to account for changes in commuting modal activity and the spill-over to non-commuting travel with greater flexibility in where and when individuals work, opening up new temporal and spatial opportunities for travel; and what all of this might mean for a broader structural change agenda linked to transport investment in the future, growing levels of car use and congestion with continued nervousness in using public transport and other modes associated with sustainability goals, the suburbanisation of activity (linked to a 15 minute city), a rethink of the value proposition of the Central Business District (renamed as a Downtown Activity Precinct), and implications for wellbeing and social exclusion.

The paper is structured as follows. We begin with an overview of the surveys undertaken over the first 22 months of the pandemic, followed by a descriptive synthesis of some of the most interesting findings in terms of the changing incidence of WFH and the accompanying views on employee productivity as perceived by employees and employers, the ways in which travel time 'savings' from reduced commuting is reallocated to other work and leisure activities, and what this means for wellbeing and general satisfaction with life. The final section offers a high level strategic and policy-focussed view on what all the findings mean for future transport and land use planning and investment. A large number of papers have been published by the authors on the Australian WFH project, and hence we avoid duplicating the detail of these papers, using the current paper to synthesise this research and outline some of the key insights as societies slowly gain an understanding of what the 'next normal' may indeed deliver.

2 A Journey through the last 22 months

The sample size, date, location and key socioeconomic characteristics are summarised in Table 1. All surveys were conducted online using the Pure Profile customer panel. The data was appropriate cleaned using widely accepted methods (extreme outliers, speed of completion, non-sensical responses) and the resulting sampling lines up well with the Australian Bureaus of Statistics (ABS) census in 2016, the latest release year (the 2021 census is yet unreleased).

Table 1. Overview of Survey Samples

	Wave 1	Wave 2	Wave 3	Wave 4	ABS*
Total Sample	1074	1457	1500	2019	n/a
Survey period	30 March – 15 April 2020	23 May-15 June 2020	4 August-10 October 2020	April-May 2021	2016
Number of workers	714	916	742	1149	
Female	52%	58%	58%	59%	51%
Age	46.3 (σ = 17.5)	48.2 (σ = 16.2)	48.2 (σ = 16.2)	48.3 (σ = 17.6)	48.2

Median Income[1]	Household = $92,826 (σ = $58,896)	Household = $92,891 (σ = $59,320)	Personal = $62,551 (σ =$46,964)	Personal= $61,410 (σ =$47,500)	Personal = $60,320 H'hold = $74,776
Have children[2]	32%	35%	35%	32%	25%
Number of children	1.8 (σ = 0.8)	1.7 (σ = 0.9)	1.8 (σ = 0.8)	1.79 (σ = 1.0)	1.8
Occupation for those working:					
Manager	1%	2%	14%	16%	13%
Professional	38%	35%	28%	27%	22%
Technician & Trade	5%	6%	6%	5%	13%
Community & Personal Services	8%	10%	10%	10%	11%
Clerical and Administration	17%	17%	22%	20%	14%
Sales	23%	22%	11%	10%	9%
Machine Operators / Drivers	2%	2%	4%	5%	6%
Labourers	5%	5%	7%	6%	10%
State					
New South Wales	22%	32%	31%	44%	32%
Aust. Capital Territory	2%	2%	1%	1%	2%
Victoria	28%	24%	24%	2%	26%
Queensland	22%	18%	22%	43%	20%
South Australia	11%	11%	9%	4%	7%
Western Australia	11%	10%	10%	4%	10%
Northern Territory	1%	1%	1%	0%	2%
Tasmania	2%	3%	1%	1%	1%

*https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/6302.0Main+Features1May%202016?OpenDocument=#:~:text=of%20Explanatory%20Notes.,TREND%20ESTIMATES,the%20same%20time%20last%20year.

The primary focus of our research has been on the States of New South Wales (NSW) and Queensland since the funding support came primarily from transport authorities in these two States. In this paper we will focus on the metropolitan areas of NSW and Queensland, referred to as the Greater Sydney Metropolitan Area (GSMA) and South East Queensland (SEQ), respectively. The GSMA includes Newcastle in the north through to Sydney and Nowra/Illawarra in the South; SEQ stretches from the Sunshine Coast in the north through Brisbane to the Gold Coast in the south. Although some preliminary modelling of commuter mode choice and the probability of WFH was undertaken using Waves 1 (Beck et al. 2020) and Wave 2 (Hensher et al. 2021), the main development of a mode choice model incorporating WFH that can be integrated into strategic transport models for the GSMA and SEQ occurred in Wave 3 (Hensher et al. 2020a) and Wave 4 (with Wave 4 reported in a later section). We ensured we had enough workers in Waves 3 and 4 to be able to estimate discrete choice models of the mixed logit form.

In addition to the first four waves, we recognised a need to get into the field during the significant lockdown (in Sydney in particular) from July 2021 to October 2021, and to also get back into the field soon after the main lockdowns were eased or totally relaxed. This results in

[1] ABS reported income is for all individuals 15 years or older, whereas we sample 18 years or older, this may explain some of the discrepancy in personal income.
[2] Our survey reports whether a household has children or not, whereas the ABS only provides a definition of a family and includes households without children in that composition.

Waves 4A and 4B where the focus was on the suite of questions related not to the requirements of a re-estimated modal choice model (reserved for Wave 5 in April 2022), but to capture the WFH responses and other associated impacts that were also identified through Waves 1 to 4. Wave 4A focussed only on the GSMA (418 individuals) and SEQ (363 individuals) and Wave 4B had 2,189 observations spread throughout four locations (GSMA=678, SEQ=850, Melbourne=437, and Perth=224).

2.1 How has the incidence of WFH changed?

Figure 2 summarises the proportion of days working that are WFH over the six periods. Waves 1 and 2 are during the initial lockdown period (see Appendix timeline) when the Federal and State governments mandated working from home unless a person's job was defined as essential and required being out of the home. We see the highest incidence of WFH at 0.697 for the GSMA in the first month of the pandemic, significantly higher than Australia as a whole (0.598) and SEQ (0.542). In part this is explained by the occupation mix of residents (Beck and Hensher 2020a). At this time the nature of the COVID-19 virus was still unknown and no vaccine existed.

As the first lockdown period progressed into its third month (June 2020), we started to see a reduction in the incidence of WFH, but still well above 0.5 for the GSMA but just below 0.5 for SEQ (Beck and Hensher 2020b). As lockdown was eased and generally relaxed except for a few conditions such as social distancing in public venues and mask wearing on public transport and other close contact venues outside the home, the proportion of days WFH reduced to an average of 0.502 for the GSMA and 0.4 for SEQ (Wave 3, Beck and Hensher 2021a, 2021b). These are still relatively high suggesting an average of 2 to 3 days a week WFH across the working population, which translates into higher averages for occupations such as professional, manager and clerical workers.

Wave 4 began a period of significant easing of most restrictions but maintaining social distancing and mask wearing on public transport. The vaccine rollout had begun, though less than 1 in 5 people in Australia were vaccinated. We now see a considerable drop in the incidence of WFH at an average of 0.280 for SEQ and 0.284 for the GSMA, closer to an average of 1 day per week. The question at the time was whether this is going to be indicative of what the 'next normal' might look like. This was soon dispelled with a major lockdown when the Delta strain took hold and Australia's view on minimising the number with the disease (in contrast to the hospitalisation rate) resulted in a lockdown similar to the earlier period at the beginning of 2020. The proportion of working days WFH sky-rocketed (Wave 4A) to 0.524 for SEQ and 0.503 for the GSMA, back to the levels in mid-2020 but not to the levels in the first months of the pandemic. As the Delta virus became contained to what was described as acceptable levels, with the 80% vaccination rate achieved for two jabs, by Mid-October the GSMA opened up with SEQ already opened up early August (but with border closures since the 80% full vaccination rate was not yet achieved as a condition for border to be re-opened). Again, we saw a significant drop in the incidence of WFH (Wave 4B) down to 0.246 for SEQ and 0.389 for the GSMA. The SEQ figure is interesting in that it is a return to the Wave 4 estimate before the lockdowns in SEQ although the GSMA average remains relatively high suggesting greater reticence to get out and about. This can in part be explained by the explosion of Omicron that had begun in mid-December 2021 and grew at an exponential rate

in NSW in particular (Figure 1). Although residents were not restricted during the Omicron outbreak, there was significant nervousness about interacting with other people, which we have described as voluntary lockdown (officially referred to as shadow lockdown by State government).

At the end of 2021 and the beginning of 2022, we are not able to suggest that we have arrived at a level of WFH that could be referred to as the forward planning estimate, but we did seek out the views of the Wave 4B sample on what they believe will be their WFH activity in the near future. This could be seen as a reliable indicator given the accumulated experience with WFH over 22 months, and Figure 2 shows the main evidence, where the dotted line is the average among all workers who indicated they want to WFH at least one day a week. If this is reinforced in planned surveys in 2022, we may be in a position after two to three years to suggest that 1 to 2 days WFH a week will become the 'next normal' average[3]. It is interesting that both Sydney and Melbourne workers who can WFH, and who have spent long periods in lockdown (especially Melbourne), are still quite positive about WFH and want it to be a high proportion of their working mix. Importantly though for transport planning in particular, we would need to obtain estimates by location (notably origin-destination pairs) with the GSMA and SEQ. We present such findings for Waves 3 and 4 in a later section.

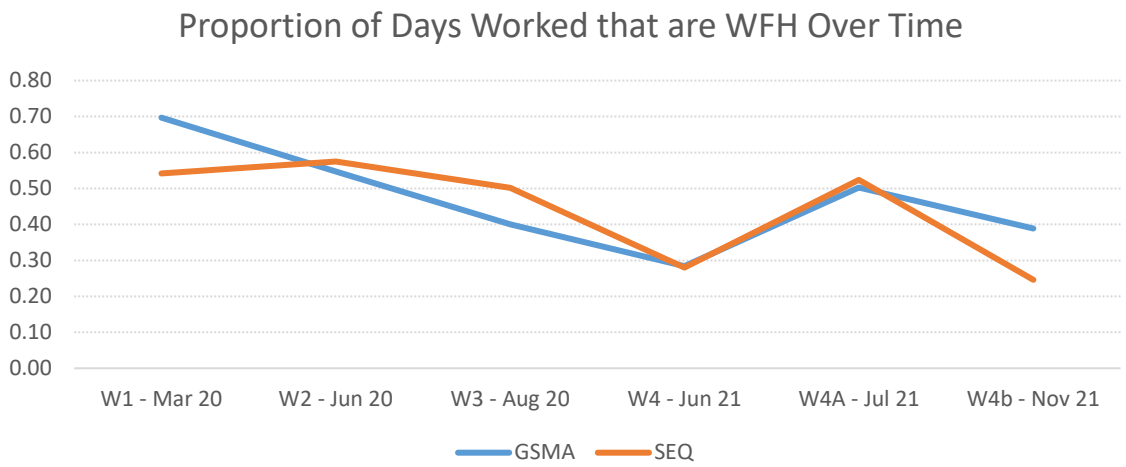


Figure 2. The proportion of working days that are working from home

[3] This is the average among ALL workers, which effectively means that ~20% of commuting volume over the week could be reduced by WFH. Of interest, as discussed in next sections, is what do they use the 'saved' time when they do not commute?

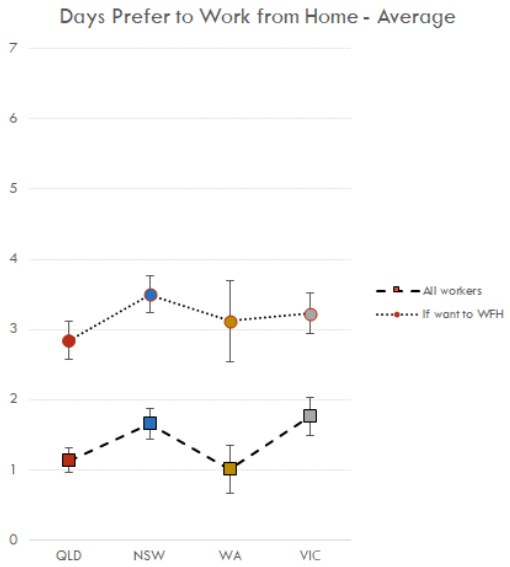


Figure 3. Number of working days that individuals prefer to work from home.

A key influence on the ability to WFH is an individual's occupation. We see in Figure 4 that employees in the categories of manager, professional and clerical/administration are more likely to be able to WFH, which aligns well with the nature of work and the ability to work from any location, in contrast to many workers in other categories such as technician and trades who cannot do their job unless they are on-site. In a number of papers such as Hensher et al. (2022a), we have developed a mapping equation to obtain variations in the probability of WFH depending on occupation in particular, and locational attributes as well as the commuting travel time. The probability obtained from the mixed logit model of the commuter choice between no work, WFH and, if commuting, mode of transport by time of day and day of the week over seven days. The mapping equation is used to obtain a spatial representation of the probability of WFH as shown for the GSMA in Figure 5.

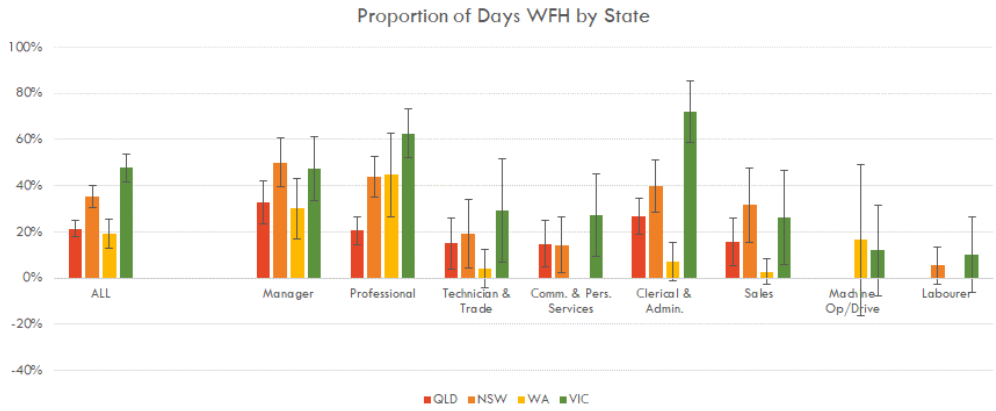


Figure 4. Percentage of working days that individuals work from home by occupation.

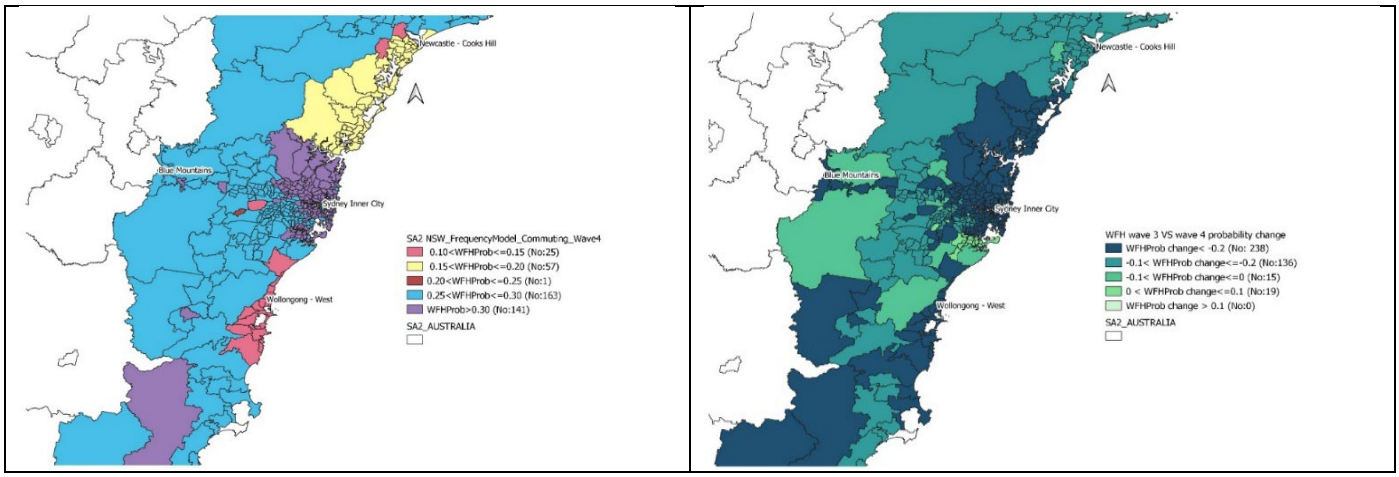


Figure 5: Probability of WFH by SA2 GSMA, Top is Wave 4; Bottom is difference with Wave 3

2.2 What do commuters do with the time saved from reduced commuting?

A particular interest is what happens to any travel time reallocated away from commuting to other activity classes as a result of increased working from home. This is a test of the extent to which the theoretical trade-offs between travel and work, and travel and leisure, and work and leisure occur under the new era of a greater incidence of working from home. Our research offers new evidence on the way in which 'saved' commuting time over a period (i.e., a week) is allocated to three main activity classes, namely paid work, unpaid work and leisure, and furthermore what are some of the statistically significant influences on this re-allocation. Details are provided in Hensher et al. (2022c). Table 2 shows that on average for those who save time from commuting, 60 mins per day is saved, with this saving being allocated on average as 45.9% to leisure, 32.1% to paid work and 22% to unpaid work. The findings are important in obtaining estimated time benefits from reduced commuting activity with such travel time being traded against work and against leisure, and what this might mean for the future travel, activity location, and lifestyle landscape.

Table 2. Descriptive Profile of the Incidence of Commuting Time Re-allocation throughout a week

	GSMA	SEQ
Commuting time saved (mins per day)	63.2 (116.8	58.5 (101.1)
Time spent doing additional work that I receive pay for (%)	32.1 (33.4)	23.9 (31.2)
Time spent doing additional work for which I receive no extra pay (%)	22.0 (25.4)	23.3 (30.6)
Time spent on leisure or family (%)	45.9 (33.9)	52.8 (38.3)
Days per week WFH only	2.8 (1.8)	2.4 (1.8)
Days per week WFH at some point	3.2 (1.6)	2.8 (1.6)
Days per week Work (from any location)	4.3 (1.6)	4.2 (1.5)

Hensher et al. (2020c) undertook a simulation of the relationship between the probability of allocating saved commuting time to each activity class as age and commuting time varies. We found that as the amount of time saved from reduced commuting increases, *ceteris paribus*, the probability of allocating a higher quantum of time to leisure and unpaid work increases and decreases for paid work. The rate of change is similar for leisure and unpaid work as the amount of commuting time saved increases, although the latter has a lower probability, suggesting that the main substitution is between paid work and both unpaid work and leisure. The simulation results in our sample suggest that, *ceteris paribus*, if a respondent saves less than 100 minutes as a result of less commuting, then they will allocate more of this time to paid work relative to

unpaid; but this will be opposite for a respondent saving more than 100 minutes as a result of less commuting. In the case of an individual's age, as age increases, *ceteris paribus*, the probability of allocating a higher quantum of time to leisure increases significantly, while it decreases for both paid and unpaid work at a similar rate, suggesting approximately equal substitution between all work and leisure activities. The results show that, *ceteris paribus*, a respondent who is 50 years old tends to allocate half of their saved time from not commuting to leisure, around 30% to paid work and 20% to unpaid work.

The Wave 4 finding does not provide enough evidence on the extent to which the reallocation of commuting time to leisure, paid and unpaid work is associated with specific activities that occur inside or outside of the home. This is important to know since any outside activity is associated with increased travel which can add to the quantum on non-commuting travel on the road network or elsewhere depending on whether active modes or public transport is used. In subsequent waves (beginning with 4B) we explore this issue more and Figure 6 summarises the allocation time to activities associated with leisure and paid/unpaid work. For the GSMA, 23% of all time saved is associated with leisure activities undertaken in the home, 18% being household tasks (i.e., chores), and 9% is associated to leisure outside of the home, i.e., a total of 50% of the saved time is allocated to leisure activities plus household tasks. The equivalent percentages for SEQ are 17.5% for leisure activities in home, 19% for household tasks, and 11% for leisure activities outside home, i.e., 47.5% of all saved time is allocated to leisure plus household tasks in SEQ.

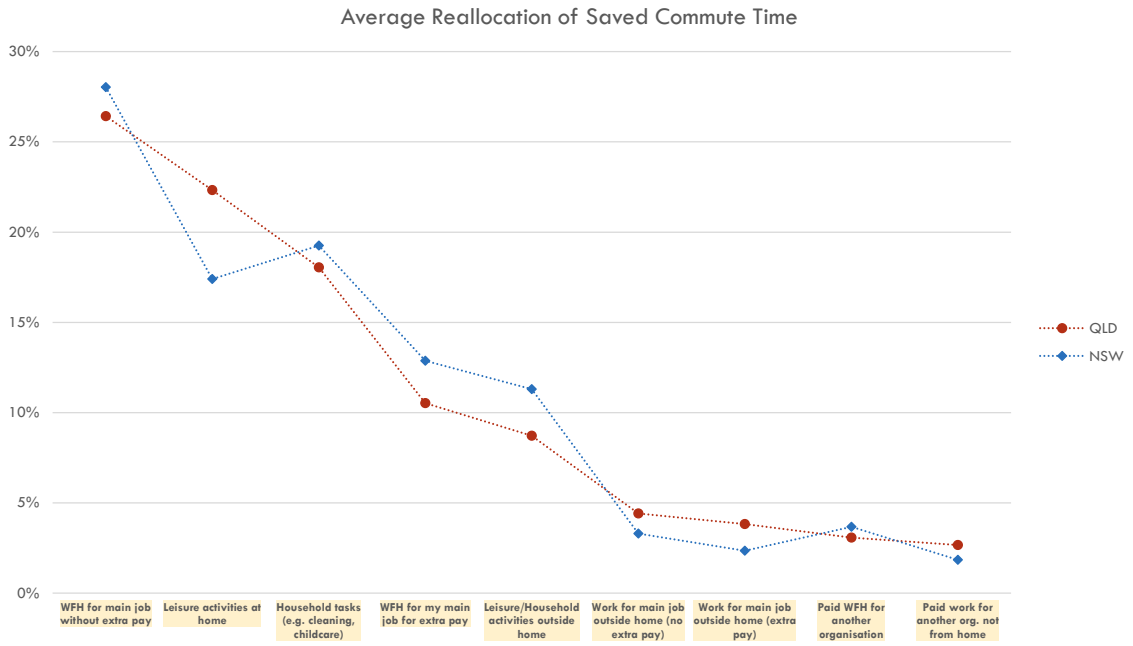


Figure 6. The breakdown of the allocation of saved commuting time within leisure and work (Wave 4B)

2.3 Does WFH and reduced commuting have a positive benefit on Wellbeing?

While we would have preferred that the virus had not taken hold, we must look forward to use this 'extreme event experience' to obtain positive benefits to individuals, households and society more broadly. This position must recognise that mental health and well-being,

including social exclusion has not gone away (see Stanley et al. 2021) and that it remains a high priority for governments as well as for business more generally.

Included in Waves 3 and 4 were a series of well-being questions identical to those used in the UK Office of National Statistics Annual Population Survey (ONS 2021), as part of their quarterly estimates of life satisfaction. The four questions used asked respondents to indicate: (i) how satisfied they are with life nowadays, (ii) how worthwhile they think things done in life are, (iii) how happy they felt yesterday, and (iv) how anxious they felt yesterday. The four well-being questions are reported on a scale from 0 representing 'not at all' to 10 representing 'completely'. Given concerns often raised about the mental health risks associated with extensive periods of WFH, we wanted to investigate the extent to which experiences with working from home, and associated impacts such as reduced stressful commuting has resulted in improved well-being or not.

We look at 'how worthwhile are the things you do in life' which is highly correlated with all except the anxiety scale. In the distribution presented in Figure 7, we see a right-skewed distribution with rating scores of 7 and 8 dominating. This already hints at evidence that satisfaction with life, in particular as people moved away from the initial peak of COVID-19 infections, was returning to some greater degree of positive 'normality', and was robust for those people who were still working during this period.

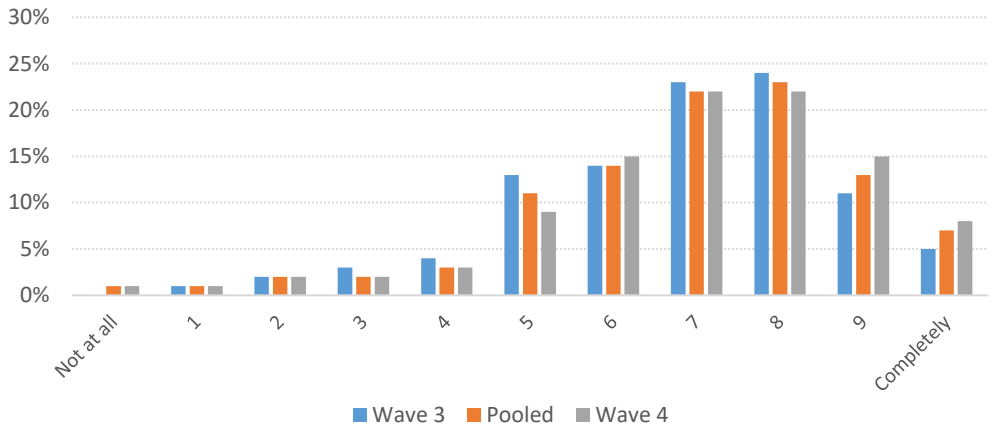


Figure 7. Distribution of the "how worthwhile are the things you do in life" statement

The detailed analysis is set out in Hensher et al. (2022d) using Waves 3 and 4 data and herein we provide a summary of the main findings as to whether there is a systematic behavioural link between well-being, with working from home, reduced commuting linked to distance to work, balancing work with non-work activities, and various socio-economic characteristics. We implement an ordered logit choice model on the 11-point scale to investigate the presence or otherwise of such a relationship. The evidence suggests that the opportunity to have reduced commuting activity linked to working from home, increased work-related productivity and an improved balance between time spent on work and time spent not working, have all contributed in a positive way to improving the worth status of life, offsetting some of the negative consequences of the pandemic. Thus, the empirical evidence suggests that some good has come out of the pandemic and the policy implication is very clear; namely, to

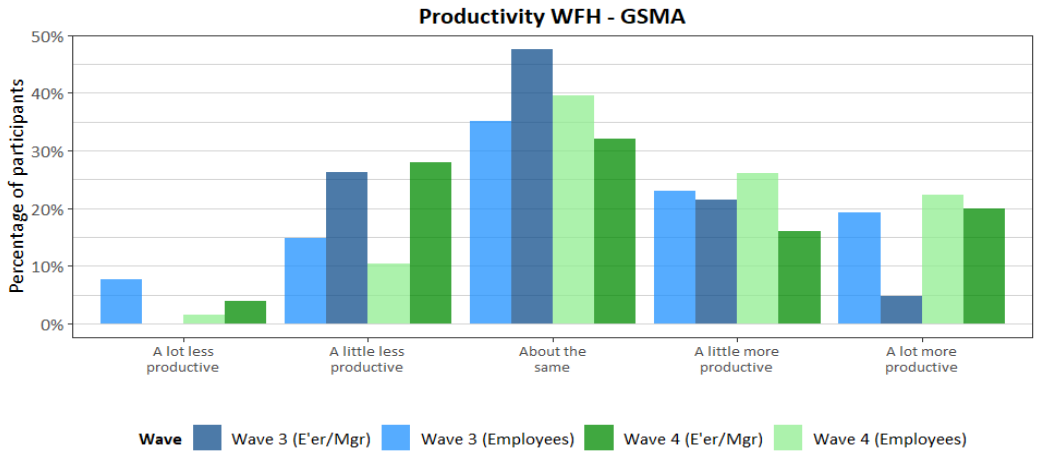
continue to ensure that people feel trusted and supported to work from home successfully, and know they are making a contribution while doing so. Meaningful work provides meaning to life.

2.4 What is the evidence on Productivity implications of WFH?

"The five-day office week is dead, long live the hybrid model", says Productivity Commission's chair, Michael Brennan (July 12, 2021, SMH)

One of the risk factors in WFH was whether it would have a negative impact on the productivity of employees. We have found that, like many other studies, productivity as perceived by both the employee and the employer has remained unchanged, and may even have increased on balance. Encouragingly, employers have been surprised, with the ability of employees to remain productive and even often increase their productivity, which has links to reduced stress associated commuting, increased flexibility in when to work, and the general improvement in lifestyle. Some of the productivity gains may also be attributable to people working more (see allocation data in Section 2.2) either because they feel they have to, or because they have nothing else to do in lockdown. The implication being that it should not be the expectation that people work longer (particularly unpaid) while WFH, otherwise that could potentially degrade the experience.

Clearly the support from employees and employers for WFH is not uniform as shown in Figure 8 (top graph), with a higher percentage of employees and employers perceiving a little more and a lot more productivity in Wave 4 compared to Wave 3, possibly partly linked to being better organised and began to see a continuing employer support for WFH. This translates in the lower graph of Figure 8 into a sizeable percentage of employees having the choice to WFH with a balanced plan (or hybrid model) of office and home. In general, we conclude that perceptions of productivity while WFH have remained constant throughout the pandemic, and even at the end of the most recent lockdown (Wave 4B, Figure 9), workers feel they are just as productive as in their regular workplace before COVID-19.



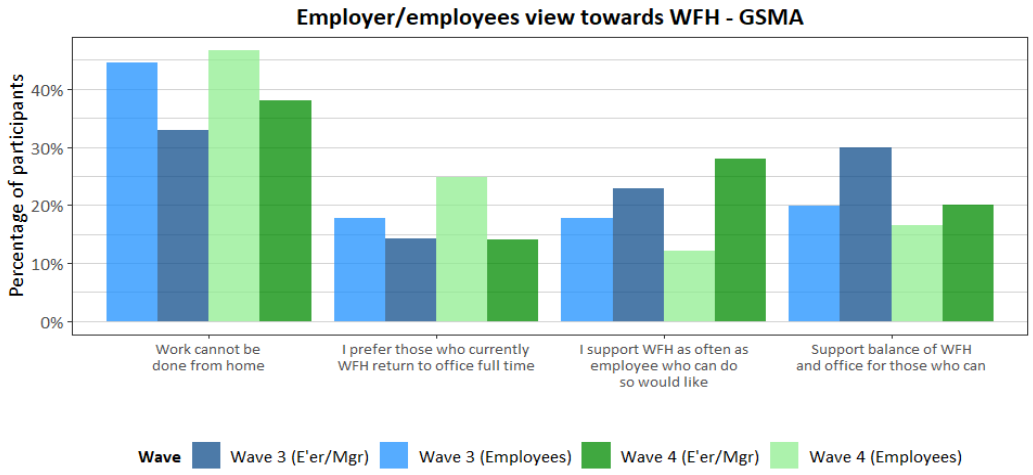


Figure 8. Perceived productivity impact of WFH by employees and employers: Waves 3 and4

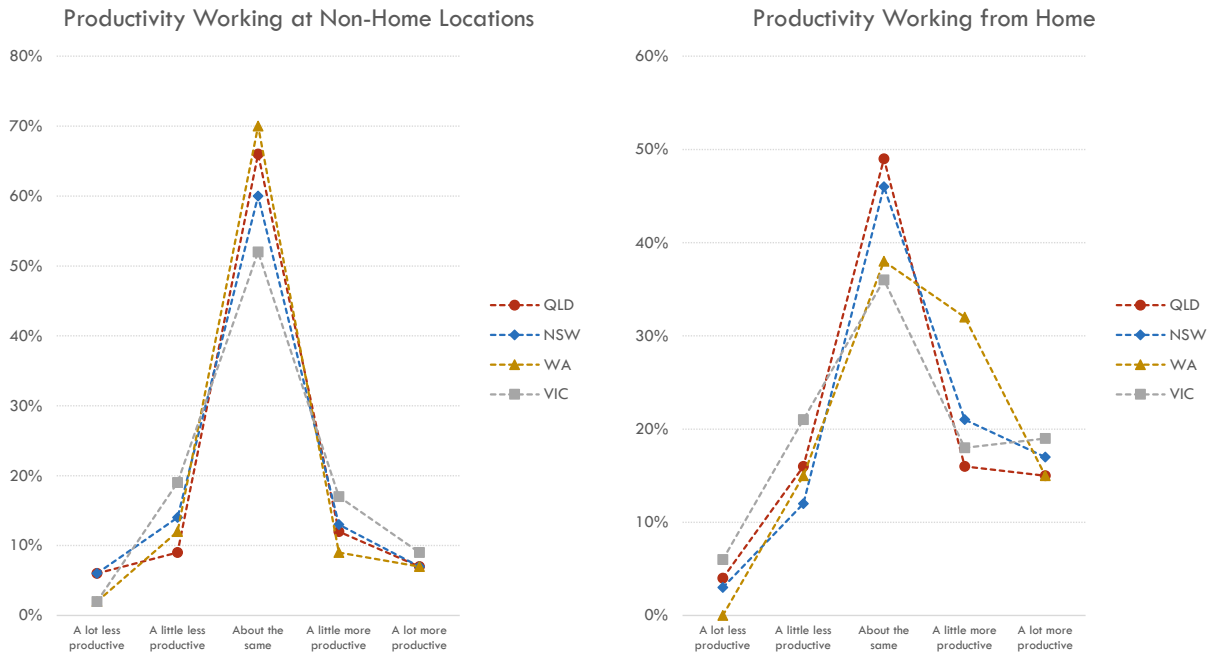


Figure 9. Perceived productivity impact of WFH by employees: Wave 4B

2.5 How might WFH impact on the Days of the Week Commuting?

Knowing the incidence of WFH is important; however also identifying what days of the week WFH occurs is important for transport planning since capacity needs are typically determined by the peak periods. Figure 10 summarises the percentage of workers who WFH on each of the 7 days of the week. In general, for each metropolitan area and wave of data, the distribution is remarkably flat across the weekdays, with a range in the latest period of Wave 4B being 26% to 30% for the GSMA and 15% to 19% for SEQ. What this suggests is that the WFH impact has spread evenly through the weekdays, which is a very encouraging sign for peak period planning; however, it is necessary to look at the evidence at an origin-destination level in order to see the extent to which this flatness is spatially widespread or not.

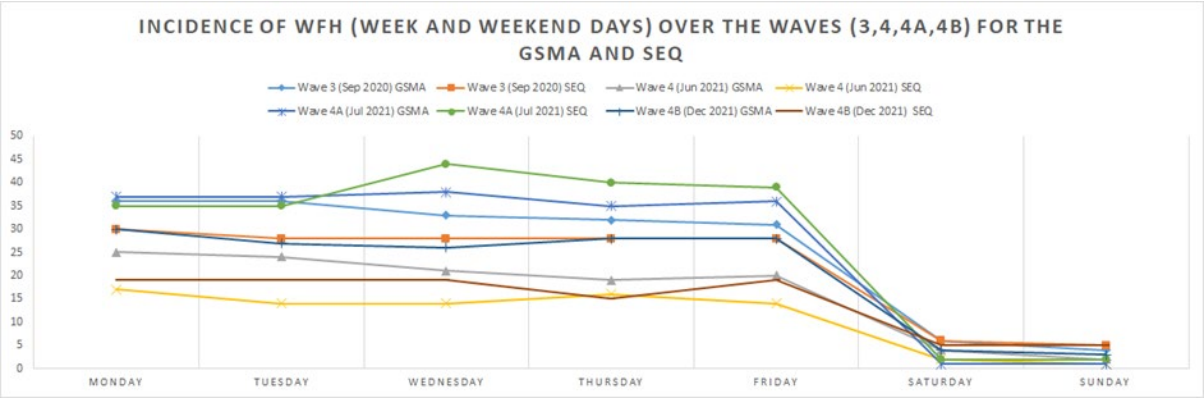


Figure 10. The incidence of WFH by day of the week across the waves for the GSMA and SEQ

2.6 The Impact of the Pandemic on Public Transport Use by Commuters: Waves 4A and 4B

Public transport patronage has taken a deep dive during the pandemic and remains at levels significantly lower than those before COVID-19. In Australian capital cities, levels have struggled to go beyond 70% of the pre-COVID-levels with patronage being as low as 45% during some periods of lockdown. Beck et al. (2021a) have looked into the barriers to public transport use and actions required to restore confidence. In this section we provide an overview of the main findings.

Commuters were asked to indicate what their main barriers were to using public transport at the present moment. The evidence for the GSMA and SEQ is provided in Figure 11. For those that are concerned, there were 14 themes emerging. The inability to social distance, and the number of other public transport users not doing so, was a concern, as was the cleanliness and hygiene status of public transport. With regards to cleanliness, reference was commonly made to the lack of overt sanitising services on-board and the large number of touch points that are required while using public transport (notwithstanding contactless ticketing). While the lack of enforcement of COVID regulations was explicitly mentioned by a small number of respondents, implicit concerns about social distancing and mask wearing are concerns about others not following the rules or being made to follow them. Concerns about the behaviour of other passengers mainly comprised of not being sure of where other people are from or where they have been, general distrust of the hygiene status of other people, and a very clear theme that many feel that people still use public transport when they should otherwise stay home because they are sick (coughing and sneezing, general germs and/or illness not just specific to COVID-19). This category could be described as a distrust of other people and generally thinking of other public transport users as inconsiderate of others.

Respondents were then asked what measures would need to be taken in order to make them feel more confident about using public transport. The most important measure is ongoing cleanliness. Many respondents stated that they had to be able to see that it was being done (either having continuing cleaning being conducted, scented cleaning materials, even an information sheet in the vestibule that informed passengers of when the carriage or bus was

last cleaned). Limits on people using public transport and/or social distancing measures combined with ongoing use of masks were also a commonly stated measures that would increase confidence. Several respondents stated that more services were required to allow for distancing to occur. A smaller number of respondents explicitly stated they wanted more enforcement of regulations. Vaccination and/or low to no case numbers would be needed for some to return to using public transport. In responses, some suggested that vaccination be mandatory for travel on public transport, and others suggested that there be vaccinated-only carriages made available. Respondents in SEQ state that having sanitiser stations or antibacterial wipes available for passengers would make them feel more confident, many stating they would be happy to wipe down their own seat if they had wipes.

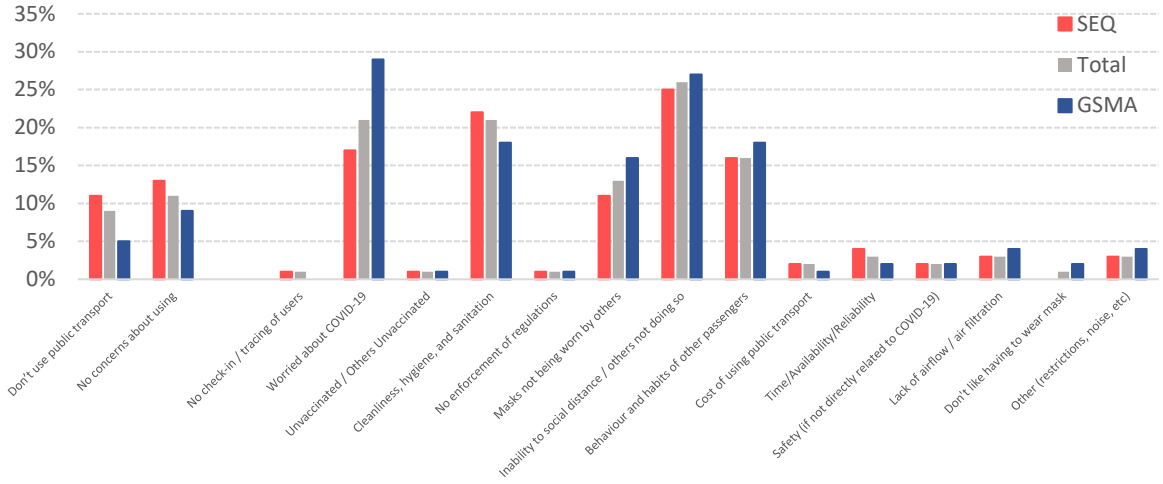


Figure 11: Commonly Stated Barriers to Public Transport Use. Wave 4A

In the December 2021 survey (Wave 4B), we asked all of the sample (commuters and non-commuters) when they felt that public transport will be safe to use. As summarised in Figure 12, 15%-55% felt it was safe now with the lower percentage being in Melbourne and the highest in Perth, this not being surprising given the duration and degree of exposure to COVID-19. Also, we see around 10% believing it will take 12 months, with 12%-20% suggesting that they are not confident about returning to public transport. These estimates align amazingly close to what many pundits are suggesting will be the longer term (10 year) return to public transport of around 80%.

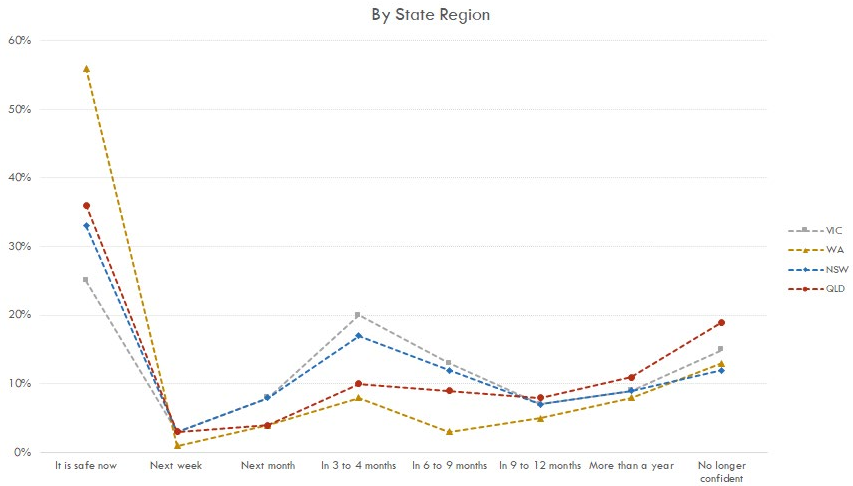


Figure 12. When will Public Transport be Safe to Use? Wave 4B

3 The Policy Message and Structural Change: Has COVID-19 helped or hindered?

'Flexibility is here to stay' and 'employers who offer a balance of WFH and in office will attract more high-quality employees' (The Future of Office Space Summit, 17 Feb 2021)

If "done right", WFH/Remote working is possibly the greatest transport policy lever we have had for many years. A defining outcome will be that more people will WFH to some extent, likely averaging 1 to 2 days a week in what has been broadly termed a hybrid work model (with fluctuations around this in the next few years) and using the reduction in commuting time to engage in increased leisure and work activity. Flexibility and convenience and reluctance to go back to pre-pandemic working norms will be key drivers of this outcome with norms around WFH being redefined. While there are advantages and disadvantages to working from home, in a non-lockdown circumstance where children are at school and businesses are open, but biosecurity conditions are front and centre, the positives seemingly outweigh the negatives. Wider literature outlines the bigger impact that WFH has had on women in families with children (particularly during periods of lockdown where schools have been closed) while prolonged working from home during lockdown periods may result in more women leaving the workforce. Conversely, it may also be possible that woman could return to the workforce if they could work from home given the flexibility such work offers. While a recurring finding is that women carry the bulk of the domestic responsibilities while working flexibly, government and business should view more flexible working arrangements through a less gendered lens, giving families more choice in how they make work and care decisions, with the ultimate potential being a higher workforce participation of women.

"More than half 54% of employees surveyed around the world said they would consider leaving their jobs if they are not given some form of flexibility regarding where and when they work." (Smarten Spaces). Many employees will want this option in their employment contracts - it will become part of negotiation and crucial to retention. Organisational resilience will need redefining or recrafting. New workers to the labour market will benefit more from face-to-face interaction to build networks (but no need to do it 5 days a week). Indeed, WFH has also become a key factor in the value proposition of different places of employment. Surveys conducted by the BBC (2021) in the United Kingdom show that 60% of workers want to work from home at least some of the time, along with a large increase in the number of job adverts referencing flexible working arrangements. A report by McKinsey finds similar results in the US, further noting a potential talent drain for companies that return to fully onsite work (Alexander et al. 2021). Organisational resilience will thus need redefining or recrafting, opening up continuing paid and unpaid work from home plus some additionally released leisure time with reduced commuting activity.

With hybrid work settings, many high-density office hubs will have a reduced number of workers at any one time, typically 80% of pre-COVID levels (Beck and Hensher 2020b). We expect greater opportunities to provide satellite/third party office space under "office space as a service" (OSaaS), including new apartment blocks with a designated office floor ('commute to work by lift'). Density then becomes increasingly a bio-security risk linked to continuing nervousness in using public transport, especially if crowding returns, and indeed the

associated higher density nodes in central metropolitan areas. Marginal residential relocation away from capital cities (exception maybe the second home) is likely to increase, noting that in Australia in the 12 months to the end of March 2021, 22,651 Melburnians moved to regional Victoria while 24,500 Sydneysiders moved to regional NSW; although a large amount was occurring regardless of COVID and WFH due to the regular cycle of residential mobility.

The enticement to relocate to outside of metropolitan areas will be driven strictly by better access and jobs in the regions. Residential choices are likely to be selected with more flexibility relative to work locations, and work locations will be chosen more flexibly relative to residential locations. There is, however, a growing view that with a day or two working from home and three to four days in the office, big cities will not wither away[4]; however remote work is likely to move the city's borders to the edge of the metropolitan area, a reflection of expanding regional labour markets. Rather than drastically changing cities, WFH has subtly reimagined city life by giving more workers more flexibility. The Brookings analysis of the USPS migration data[5] concluded that remote work will settle into a new level, higher than pre-pandemic but lower than the present. The hybrid-work environment is pushing people to live within travelling distance near work, but not quite as close as they used to. Local amenity and the built environment will likely play a large role and require a more localised focus on what constitutes areas that are accessible for active travel, which has spiked during the pandemic.

We can anticipate greater use of cars for all trip purposes and increased local (suburban) trip congestion (linked also with higher rates of passenger car registrations) in large measure due to the bio-security concerns in using public transport: Google Mobility data has consistently shown car usage to rise to above pre-pandemic levels in many countries. Staggered working hours are hypothesised to contribute to changing levels of road traffic as a result of more single–occupant car use; spreading demand better over the day, with the level of traffic in the peak hours associated with commuting lowering as offices reduce capacity at any one time. However non-commuting traffic is also changing and some of this is moving to peak periods as a result of greater flexibility in when work is done, while also adding to traffic throughout the day, in both the traditional peak and off-peak periods. Finally, cost constraints on using the car to commute may also be reduced as a person travels to work fewer times during a given week. Additionally, it has been shown that, for a variety of reasons, telecommunications and travel are complementary (Choo and Mokhtarian 2007), which could further lead to increased localised travel in particular by car.

How this change in car usage may impact on congestion is unknown at this stage and needs careful monitoring by transport authorities. Ideally, increased working from home would help reduce congestion and crowding due to a lower aggregate number of commuting trips. However, should barriers to car use be reduced (in particular cost) and to public transport be increased (due to bio-security concerns), we could see that when commuting is done the car

[4] https://www.businessinsider.com.au/remote-work-made-cities-bigger-nyc-san-francisco-metro-areas-2021-9

[5] https://www.brookings.edu/blog/the-avenue/2021/06/24/remote-work-wont-save-the-heartland/

becomes an even more dominant alternative. If this is the case, then transport authorities should work closely with businesses to ensure peak spreading is encouraged, and ultimately it may indeed strengthen the need for a more efficient form of road pricing than currently exists.

The quality of the living environment will become more important including larger units, an office at home, and enhanced digital connectivity. Linked to WFH, increased online activity by workers reinforces the possibility of a 15-30 minute city, a residential urban concept in which most daily necessities can be accomplished by either walking or cycling from residents' homes, which in the past has been especially hampered given it is mainly related to closer commuting locations with satellite offices.

Acknowledgments. This research is part of iMOVE Cooperative Research Centre (CRC) research projects 1-031 and 1-034 with Transport and Main Roads, Queensland (TMR), Transport for News South Wales (TfNSW) and WA Department of Transport (WADoT) on Working for Home and Implications for Revision of Metropolitan Strategic Transport Models. The findings reported are those of the authors and are not the positions of TfNSW or TMR; but approval to present these findings is appreciated.

Declarations of interest: none.

References

Balbontin, C., Hensher, D.A., Beck, M.J., Giesen, R., Basnak, P. (2021) Vallejo-Borda, J.A., Venter, C. Impact of COVID-19 on the number of days working from home and commuting travel: A cross-cultural comparison between Australia, South America and South Africa, **Paper #12**, *Journal of Transport Geography*, 96, 103188

Beck, M. and Hensher, D.A. (2020a) Insights into the Impact of Covid-19 on Household Travel, Work, Activities and Shopping in Australia – the early days under restrictions, **Paper #1**, *Transport Policy,* 96, 76-93. https://doi.org/10.1016/j.tranpol.2020.07.001 (one of top most downloaded papers in the journal).

Beck, M. and Hensher, D.A. (2020b) Insights into the impact of COVID-19 on household travel and activities in Australia – the early days of easing restrictions, **Paper #4**, *Transport Policy*, 99, 95-119. Online 19 August 2020 https://doi.org/10.1016/j.tranpol.2020.08.004.

Beck, M.J. and Hensher, D.A. (2020c) What does the changing incidence of Working from Home (WFH) tell us about Future Transport and Land Use Agendas? *Transport Reviews*, 41(3). (Shortened version for *The Conversation*, November 2020 to accompany Academy of Social Sciences Australia (ASSA) podcast). https://doi.org/10.1080/01441647.2020.1848141. Also https://theconversation.com/covid-has-proved-working-from-home-is-the-best-policy-to-beat-congestion-148926

Beck, M. J. and Hensher, D.A. (2021a) Australia 6 months After COVID-19 Restrictions Part 1: Changes to Travel Activity and Attitude to Measures **Paper #7a**. Transport Policy, online 17 June 2021.

Beck, M. J. and Hensher, D.A. (2021b) Australia 6 months After COVID-19 Restrictions Part 2: The Impact of Working from Home **Paper #7b**. Transport Policy, online 17 June 2021.

Beck, M. J., Hensher, D.A. and Wei, E. (2020) Slowly coming out of COVID-19 restrictions in Australia: implications for working from home and commuting trips by car and public transport, **Paper #3**, Journal of Transport Geography, 88, 102466.

Beck, M.J., Hensher, D.A., and Nelson, J.D. (2021) Public transport trends in Australia during the COVID-19 pandemic: an investigation of level of concern as a driver for use, **Paper #9**, Journal of Transport Geography, online 96, 103167.

Beck, M.J., Nelson, J., and Hensher, D.A. (2021a) Restoring Confidence in Public Transport post Delta COVID-19 Lockdowns: Identifying User Segments and Policies to Restore Confidence, **Paper #20**, submitted to International Journal of Sustainable Transportation, November 2021.

Choo, S., Mokhtarian, P.L. (2007) Telecommunications and travel demand and supply: Aggregate structural equation models for the US, Transportation Research Part A: Policy and Practice, 41(1), 4-18.

Hensher, D.A., Beck, M.J. and Balbontin, C. (2021) What does the quantum of working from home do to the value of commuting time used in transport appraisal? **Paper #10**, Transportation Research Part A, 153, 35-51.

Hensher, D.A., Wei, E., Beck, M.J. and Balbontin, C. (2021a) The impact of COVID-19 on the time and monetary cost outlays for commuting - the case of the Greater Sydney Metropolitan Area after three months of restrictions, **Paper #5**, Transport Policy, 101, 71-80.

Hensher, D.A., Beck, M. J. and Wei, E. (2021) Working from home and its implications for strategic transport modelling based on the early days of the COVID-19 pandemic, **Paper #2**, Transportation Research Part A, 148, 64-78.

Hensher, D.A., Wei, E, and Liu, W. (2021b) Accounting for the spatial incidence of working from home in MetroScan - an integrated transport and land model system, Paper #19, submitted to Transportation Research Part A, 5 November.

Hensher, D.A., Beck, M.J., Nelson, J.D. and Balbontin, C. (2022) Reducing congestion and crowding with WFH, in Mulley, C. and Attard, M. (editors) Transport and Pandemic Experiences, Emerald Press, **Paper #14**.

Hensher, D.A, Balbontin, C., Beck, M.J. and Wei, E. (2022a) The Impact of working from home on modal commuting choice response during COVID-19: Implications for two metropolitan areas in Australia, Paper #8 For a Special Issue on COVID-19 (edited by Hani Mahmassani and Patricia Mokhtarian), Transportation Research Part A, 155, 179-201.

Hensher, D.A. and Beck, M. J. (2022b) Exploring the link between working from home and how worthwhile the things that you do in life are during COVID-19. **Paper #21**, submitted to Transport Policy, 20 January 2022.

Hensher, D.A., Beck, M. and Balbontin, C. (2022c) Time allocation of reduced commuting time during COVID-19 under working from home, **Paper #18**, submitted to Journal of Transport Economics and Policy, 29 September 2021, revised February 2022.

Hensher, D.A. and Beck, M. J. (2022d) Exploring the link between working from home and how worthwhile the things that you do in life are during COVID-19, Paper #21. Submitted to Transport Policy 20 January 2022.

ONS (2020) Personal Wellbeing in the UK, Office of National Statistics, https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/bulletins/personalwellbeingintheukquarterly/april2011toseptember2020, accessed 01/12/21.

Ory, D., and Mokhtarian, P.L. (2005) When is getting there half the fun? Modelling the liking for travel, Transportation Research Part C, 17, 642-661.

Stanley, J., Hensher, D.A., Stanley, J. and Vella-Brodrick, D. (2021) Valuing changes in wellbeing and its relevance for transport policy, Transport Policy, 110, 16-27.

Stanley, J.K., Hensher, D.A. and Stanley, J.R. Place-based disadvantage, social exclusion and the value of mobility, submitted to Transportation Research Part A, 4 November 2021, referees reports 29 January 2022, revised 1 February 2022.

Appendix

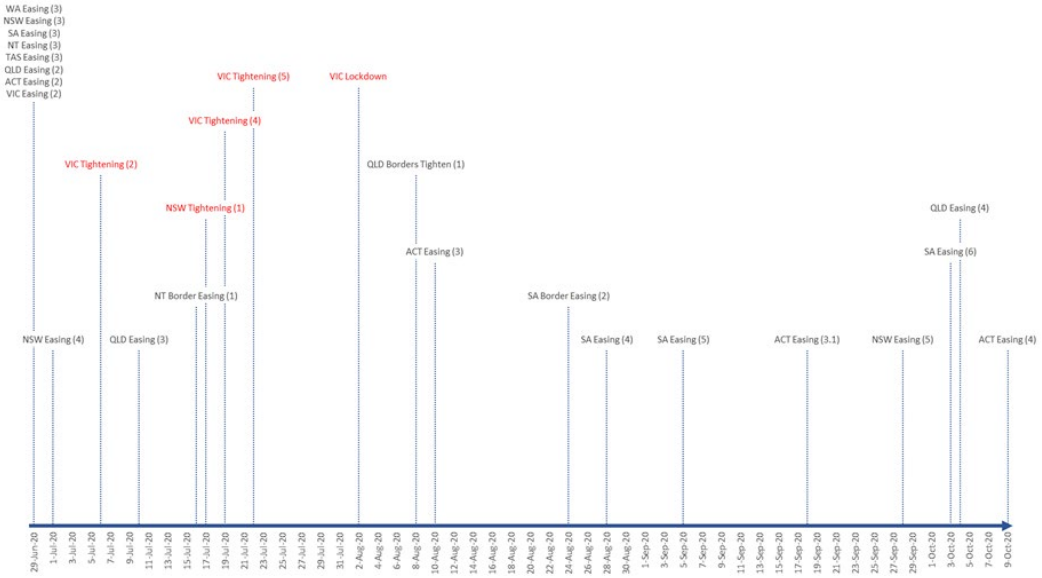


Table 1: Summarising Key Events in an Ongoing COVID-19 Timeline

26/06/2020 (Current position for all states)	WA Easing (3)	Revision of spacing to 2sqm, non-work gatherings limited to 200 Venues with appropriate space limit of 300, gyms, cinemas and galleries reopen
	NSW Easing (3)	Pubs, clubs, cafes and restaurants limit of 50 customers
	SA Easing (3)	No limit on non-work gatherings other than 4sqm rule 2sqm rule may apply to smaller venues, nightclubs remain closed
	NT Easing (3)	All but 4sqm rule remains, some small venues allowed 2sqm per person
	TAS Easing (3)	Gatherings at households remain limited to up to 20 people Space require now 2sqm, upper limit of 250 indoors and 1000 outdoors
	QLD Easing (2)	Gatherings of up to 20 in homes and public spaces, gyms and non-contact sport allowed, Museums and galleries open, no limit on recreational travel
	ACT Easing (2)	Face to face higher education resumes, cinemas and movies open, theatres and galleries open, max of 100 people for indoor and outdoor with 4sqm rule
	VIC Easing (2)	Cafes, Restaurants, Pubs, Bars, museums, galleries have 50-person limit Cinemas, concert venues, theatres open with limit of 50 (with 4sqm rule)
30-Jun-20	VIC Tightening (1)	Re-enforced local lockdowns across 10 different Melbourne postcodes
1-Jul-20	NSW Easing (4)	All businesses, can reopen with exception night clubs No limit of numbers other than 4sqm rule being observed
2-Jul-20	WA Easing (4)	All existing gathering limits and the 100/300 rule removed All events permitted except for large scale, multi-stage music festivals
6-Jul-20	VIC Tightening (2)	additional two postcodes affected by the lockdown
8-Jul-20	NSW Borders Tighten (1)	NSW closes border to VIC due to Melbourne outbreak First time since the 1919 Spanish Flu epidemic
9-Jul-20	VIC Tightening (3)	Metro Melbourne and Mitchell Shire in lockdown 6 weeks
10-Jul-20	QLD Easing (3)	Gatherings 100 people permitted, community sport and fitness resumes, casinos, gaming and gambling venues and nightclubs open, 4sqm rule applies, visitors from all states and territories other than Victoria (border pass required)
16-Jul-20	NT Border Easing	NT opens borders with all states except for hotspots (Greater Sydney and VIC)
17-Jul-20	NSW Tightening (1)	Per-table seating reduced from 20 to 10, max of 300 in any venue
19-Jul-20	VIC Tightening (4)	Face coverings mandatory in metro Melbourne and Mitchell Shire outside of home
22-Jul-20	VIC Tightening (5)	Visit in aged/health care restricted to carers only and a limit of one hour per day
2-Aug-20	VIC Lockdown	State of disaster declared, curfew in Melbourne from 8pm to 5am enforced
2-Aug-20		**200 National Deaths**

8-Aug-20	QLD Borders Tighten (1)	Closure of border to New South Wales and the ACT
10-Aug-20	ACT Easing (3)	In and outdoor gatherings limited to 100 people, casinos and gambling venues, food courts, spas, gyms reopen
11-Aug-20		**300 National Deaths**
18-Aug-20		**400 National Deaths**
24-Aug-20		**500 National Deaths**
24-Aug-20	SA Border Easing (2)	Border with NSW reopens
28-Aug-20	SA Easing (4)	Residential gatherings allowed to have a max of 50 people
30-Aug-20		**600 National Deaths**
5-Sep-20		**700 National Deaths**
5-Sep-20	SA Easing (5)	Wedding or funeral increase to 150 people, food and alcohol service resumes for those seated at a bar
13-Sep-20		**800 National Deaths**
18-Sep-20	ACT Easing (3.1)	Small sized venues and facilities return to their pre-COVID capacity (25 max)
28-Sep-20	NSW Easing (5)	Theatres, cinemas and concert halls new capacity of 50%, to a max of 1000
3-Oct-20	SA Easing (6)	Private functions, weddings and funerals allowed 150 people, dancing permitted, standing consumption of food and beverages at both indoor or outdoor events
4-Oct-20	QLD Easing (4)	Standing eating and drinking permitted at indoor and outdoor venues, outdoor venues 2sqm rule, max of 1000 at outdoor event, stadium seated capacity to rise to 75%
9-Oct-20	ACT Easing (4)	Gatherings max of 200 people, cinemas and theatres 50% capacity, large indoor venues 50% (up to 1000)

Waves 4A and 4B Timeline

- **South East Queensland:**
  - Went into lockdown on June 29th for 3 days
  - Went into lockdown on July 31st for 3 days
  - Lockdown extended to 8th of August
- **Greater Sydney Metro Area:**
  - Went into lockdown on the 1st of July, on 7th of July extended for another week
  - Extended on 14th of July for another two weeks
  - 17th of July restrictions were tightened in LGAs of concern
  - 21st of July lockdown areas expanded to parts of regional NSW
  - 28th of July lockdown extended for another four weeks
  - 20th of August further extension and tightening of lockdown restrictions
  - 26th of August regional lockdown extended
  - 11th of September regional lockdown partly lifted
  - 6th of October several regional lockdowns extended
  - 11th of October state-wide lockdown significantly ease
  - 16th of October 80% full vaccination levels reached
- **Perth:**
  - 27th of June restrictions in Perth/Peel regions tightened for 3 days (masks on PT, social distance rules)
  - 28th of June four day lockdown started in said region
- **Melbourne:**
  - 14th of July face mask mandates introduced
  - 15th of July four day lockdown announced (3rd of 2021)
  - 20th of July lockdown extended
  - 27th of July lockdown restrictions lifted
  - 5th of August a seven day lockdown was implemented

- 11th if August lockdown extended for 7 days, then by two weeks on 16th of August
- 2nd of September lockdown was extended until 23rd of September
- Lockdown extended until restrictions start to ease on 23rd of October