UTTRI

Research Report

An Assessment of the Impacts of COVID-19 Lockdown in Summer 2020 on Activity-Travel Behaviour in the Greater Toronto Area:

Results from Cycle-1 of CASAS Satellite Survey

Alireza Dianat, Jason Hawkins, Khandker Nurul Habib

August 2020

Civil & Mineral Engineering
UNIVERSITY OF TORONTO

UTTRI

An Assessment of the Impacts of Covid-19 Lockdown in Summer 2020 on Activity-Travel Behaviour in the Greater Toronto Area: Results from Cycle-1 of CASAS Satellite Survey

Alireza Dianat
Jason Hawkins

Professor Khandker Nurul Habib
khandker.nurulhabib@utoronto.ca

AUGUST 2020

Introduction

Shortly after the emergence of the novel coronavirus (COVID-19) in December 2019 in Wuhan, China, it had spread globally (1). As a first effort to cut the chain of infection, Toronto and Ontario decision-makers restricted all out-of-home activities. The list of closed places to cut the spread of disease included, but was not limited to, offices, shopping centers, educational buildings, and recreational facilities. As individuals could not travel to/attend the locations of their desired activities, they adopted alternative methods to perform these activities.

With the tools and services provided by the internet and communication technologies (ICT), many out-of-home activities were substituted by in-home alternatives. For instance, workers practiced telecommuting, students' classes continued remotely, e-shopping took the place of in-store shopping, and serving food in restaurants shifted to order-at-home with delivery.

It is not the first time that the transportation system faced a large-scale disruption (2). Usually, individuals and households respond to these disruptions by temporarily adopting new activity-travel behaviour, while eventually reverting to their previous habits. However, some specific factors make this lockdown different from previous cases. The COVID-19 lockdown has no recent similar example in geographical distribution and lasting duration. The alternative methods of doing activities during this lockdown were globally practiced, optimized, and carefully selected, expecting that these new patterns would need to be continued for at least several months. Thus, these patterns have the potential to be continued in the post-COVID era.

Besides, the easy access to the internet and the prevalent use of computers and smart-gadgets also differentiate the COVID-19 lockdown by providing alternatives for doing many activities from a distance. Thus, these different characteristics cause this unrivaled lockdown to have more complicated impacts on individuals' daily activity-travel behaviour.

In the summer of 2020, after the second stage of reopening started in Toronto, Canada, an online survey was conducted by the Travel Demand Modeling Group of the University of Toronto. This survey explored the impact of the COVID-19 lockdown on the Greater Toronto Area (GTA) residents' daily activity-travel behaviour.

Figure 1 Map of the Greater Toronto Area (GTA) (3)

The purpose of this survey was to collect evidences on the impact of the COVID-19 lockdown on individual activity patterns: working, shopping, eating, and visiting. The report presents the summaries of preliminary analyses and take-away lessons.

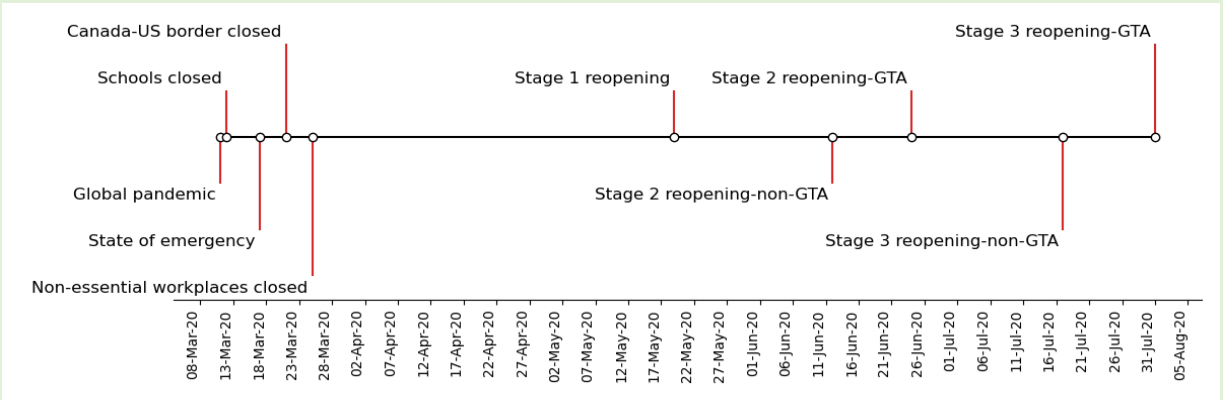


Figure 2 COVID-19 Timeline in Toronto, Canada (5,6)

The Survey

As per 2016 census, there are about 2,985,000 workers over 15 years old in the GTA. Of these workers, 7.31% telecommute, and 11.60% do not have a fixed workplace address (4). Considering the benefits of tele-activities with the extent of telecommuting evident in the daily routines, telecommuting has been a key focus of transportation policymakers and travel demand modellers. The COVID-19 lockdown was a good chance to see its full potential. To this end, the survey included questions about the frequency of performing various activities from home and out-of-home before the COVID-lockdown, during the lockdown, and shortly after the reopening stage. The survey was designed in an online survey platform and data collection was by using an online panel. The survey questionnaire was circulated to several professional researchers and companies in the field of transportation analysis, and their feedback was incorporated into the final version of the survey. The data collection procedure began on July 10, 2020, with the pilot phase and continued until July 28, 2020.

After cleaning incomplete records, 918 completed responses were obtained for use in the analysis. Fig. 4 shows the conformity of the collected sample with the true population for various sociodemographic dimensions.

In the first part of the survey, participants were asked about their sociodemographic characteristics, as well as their employment status (and that of other members of their household). Then, the survey collected information about individuals' and households' sensitivity to the COVID-19 pandemic and the resulting lockdown from various viewpoints like health, general behaviour (Fig. 3), and employment (Fig. 5). Next, participants' revealed choices from possible ways of doing some frequent activities (e.g., work, shop, visit, eat) were obtained for three time-intervals: prior, during, and post COVID-19 lockdown. Data were collected to investigate changes in activity participation due to this disruption on daily life.

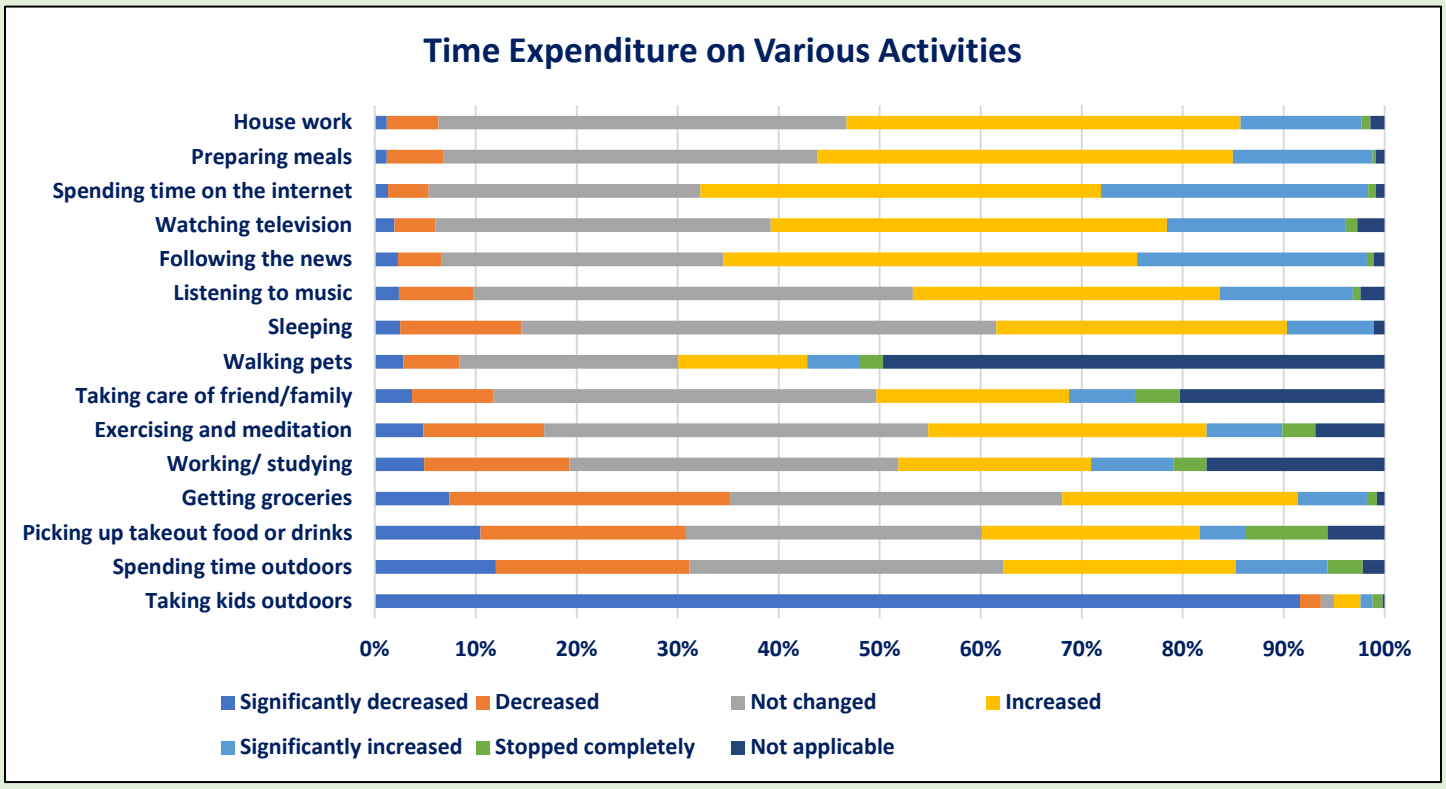


Figure 3 The difference in time expenditure on different activities, comparison of before and during lockdown

Survey Design

Later in the survey, respondents were given two sets of stated preference choice cases (8 scenarios for choosing shopping method and the same number for work location choice) to probe into the possible influencing factors (e.g., pandemic concern, facilities, travel characteristics) on personal preferences. “The proportion of population received the vaccine” and “the achievable social distancing” are two pandemic related attributes included in choice cases with different levels.

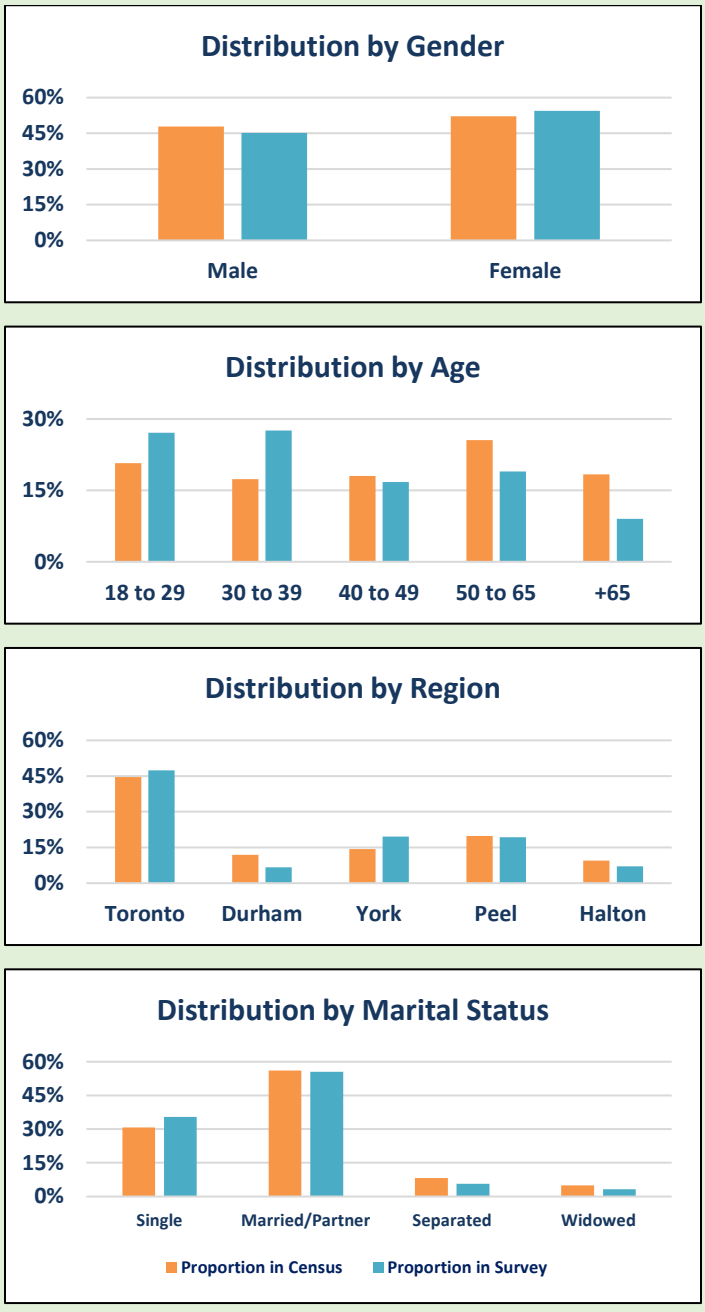


Figure 4 Conformity of sample to the real population in different sociodemographic factors

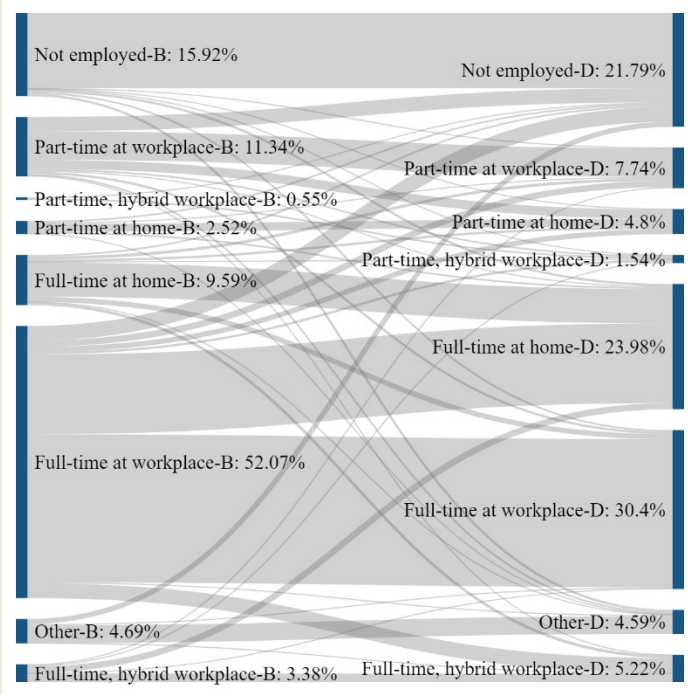


Figure 5 Comparison of employment status before and during lockdown among survey respondents.

The last part of the survey collected information on the attitude of respondents regarding work location options (home or workplace) and shopping method alternatives (online or in-store). The participants stated to what extent they agreed or disagreed with the advantages and drawbacks of each option. Also, they were given several agreement questions representing a set of possible reasons to choose an alternative to see their reasoning procedure for further causality analysis. This section also included some questions about the change in different activities at work and the respective variation in subjective wellbeing experienced by the respondents.

Households’ special care required members

18% of respondents have at least one child less than 6 yo*

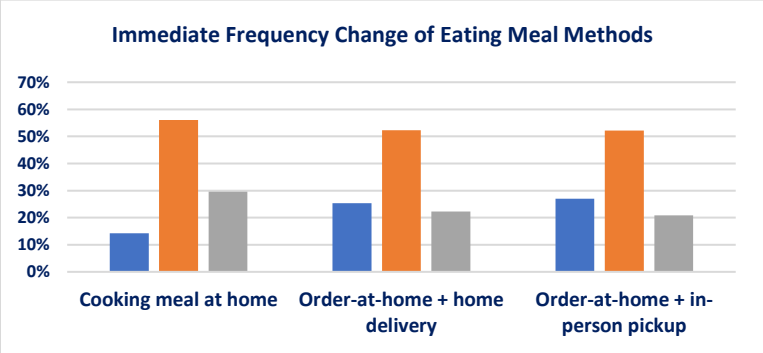
33% of respondents have at least one child between 7-16 yo*

28% of respondents have at least one adult above 60 yo*

*years old

Frequency of Meal Preparation/Eating Methods

More than 50% of respondents reported no immediate change for practicing various meal preparation methods. However, for the other 50% of respondents, the health concern of out-of-home prepared food leads to an average reduction of food ordering. The trends show the substitution of out-of-home prepared meals with self-cooked meals. Also, ordered food with in-person pickup experienced a smaller drop than home delivery. Shortly after reopening started, respondents got back to their behaviour for most of the meal preparation/eating methods. This observation reveals the respondents' inertia for eating meal methods. Going out to the restaurant is the only option that on average has a drop in the short-term. This reflects the concern of respondents about getting infected by going to a restaurant after reopening.



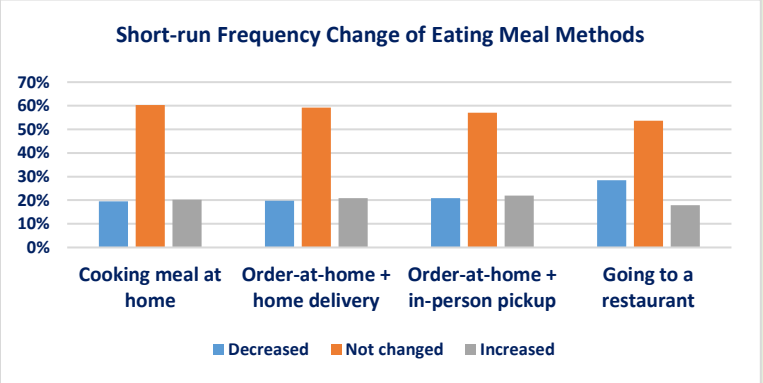
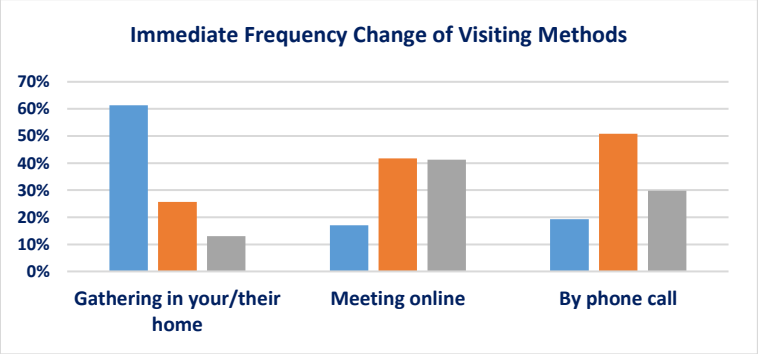


Figure 6 Immediate and short-run impact of COVID-19 on the practiced method of preparing/eating meals

Frequency of Visiting Methods

The restriction regulation about indoor gathering during COVID-19 lockdown led to an immediate frequency drop for about 61% of the respondents. A 41% increase versus a 17% decrease reported for the use of online meetings during the lockdown represents the new wave of tele-meeting users. On average, the use of phone calls during the pandemic grew; 29% of respondents reported an increase versus 19% reporting a decrease.

The rise of alternative options for in-person visiting shows the potential substitution pattern. Shortly after the reopening, the frequency of using a phone call for socializing returned to its average, which suggests a low probability of increased phone use in the post-COVOD-19 era. However, the large proportion of respondents reporting increased use of online meetings supports the hypothesis of a new behavioural routine practiced during the lockdown that will continue.



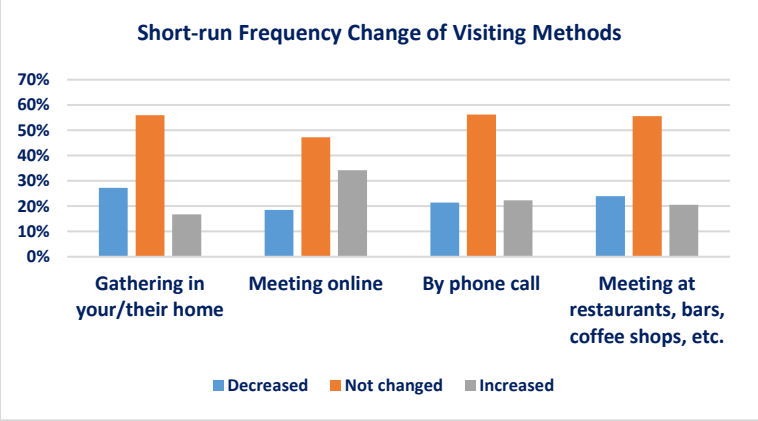


Figure 7 Immediate and short-run impact of COVID-19 on the practiced method of visiting

Frequency of Non-Grocery Shopping Methods

Although the demand for shopping with home delivery did not change on average, more than 50% of respondents indicated a change in their behaviour. Shortly after reopening, in-store shopping dropped relative to before the lockdown. However, online shopping did not continue increasing. The effect of online sales as a temporary incentive for non-grocery shopping was damped after a while. Thus, a further detailed longitudinal analysis is needed to find the potential behavioural change for non-grocery shopping.

Frequency of Grocery Shopping Methods

Although more than 40% of people kept their in-store grocery shopping routine during the lockdown, the ones who less frequent shopped was 20% more than more frequent shoppers. This difference is less for wholesale markets as people can keep more physical distances. On the other hand, providing a new service of online ordering with home delivery from some companies, as well as health concerns, increased the share of e-shopping during the lockdown. Shortly after reopening, the difference between the proportion of more frequent and less frequent shoppers decrease. For wholesale markets, this difference becomes negligible but supermarkets still vary by 7%. The noticeable pattern of increase in grocery e-shopping continued which means a new pattern of in-home activities induced by practicing new behaviour during this lockdown.

Participants' Access to Facilities at Home

- **90.9%** Internet connection
- **93.6%** Laptop or PC
- **37.2%** Secondary monitor
- **72.5%** Printer
- **65.5%** Work desk
- **37.3%** Office room

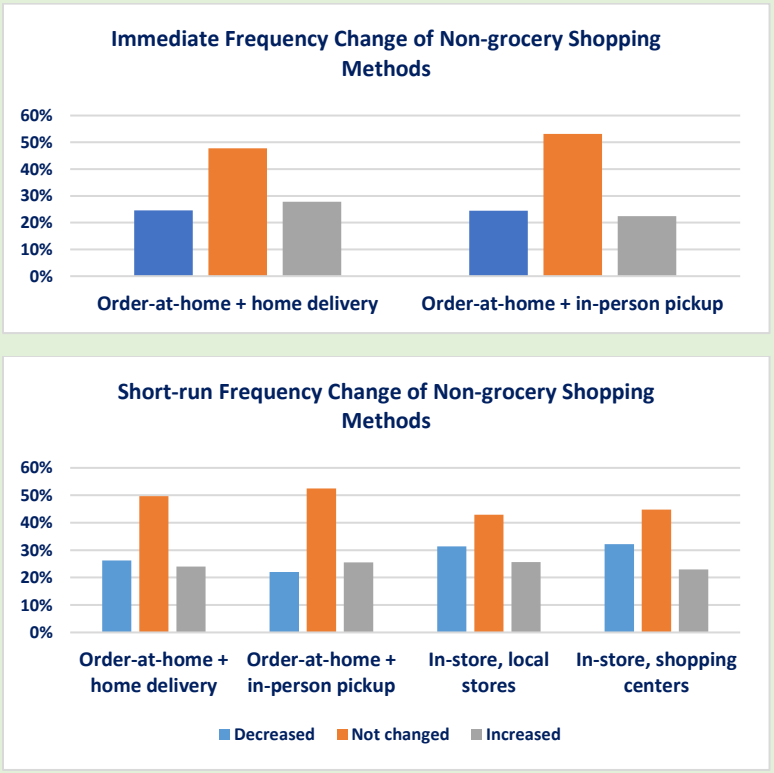


Figure 8 Immediate and short-run impact of COVID-19 on the practiced method of non-grocery shopping

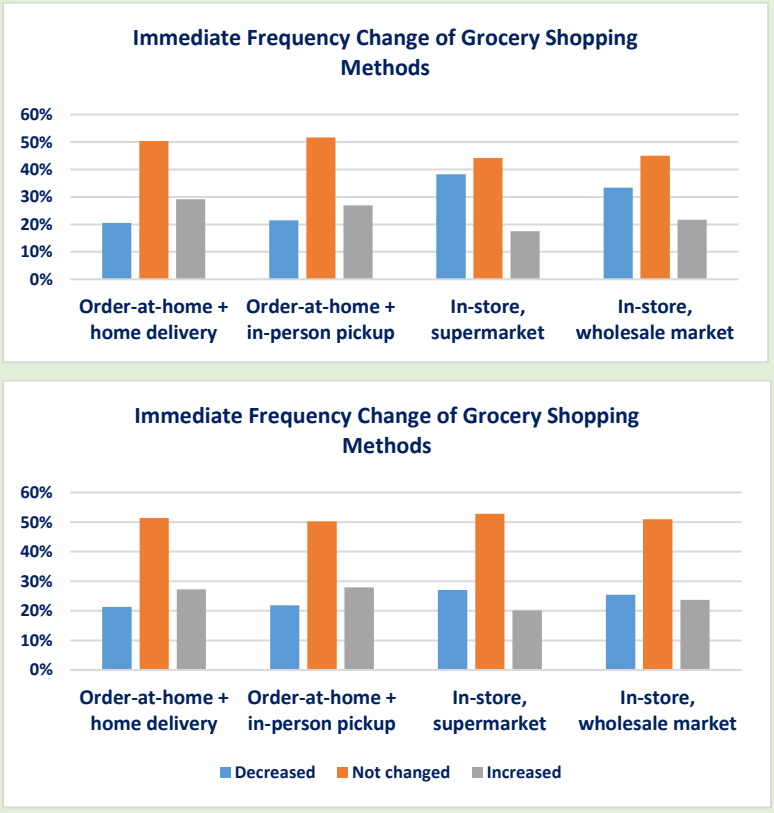


Figure 9 Immediate and short-run impact of COVID-19 on the practiced method of grocery shopping

Working from home

The effect of lockdown on workers differs from part-time to full-time workers. 30% of full-time workers are not affected by lockdown, and 38% of them were switched to teleworking. Contrary to full-time workers, the part-time ones were harmed more by the COVID-19 lockdown. Comparing the 40% of part-time workers who are not affected or continued working from home, 29% of them experienced a work-hour reduction, and 30% lost their job (Fig. 10).

In the current sample, 32% of respondents have experienced working from home more than once a month before the lockdown. The distribution of frequency and types of telecommuting practiced by these people summarized respectively in Fig. 11 and 12. About 70% of distance workers have been practicing this method recently at least once a week: home-based businesses and overflow working from home shape 50% of distance working.

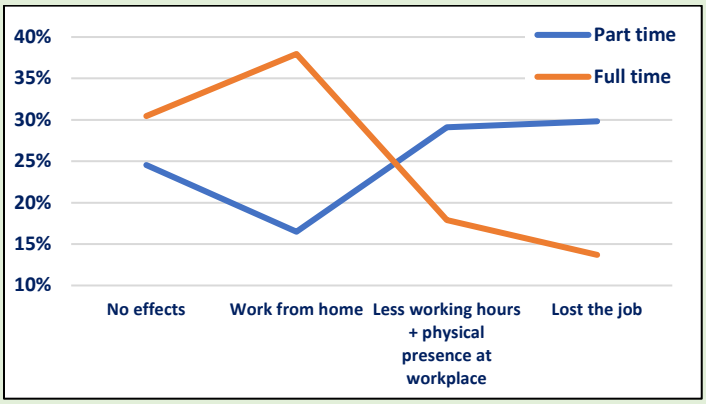


Figure 10 Effect of lockdown on working status

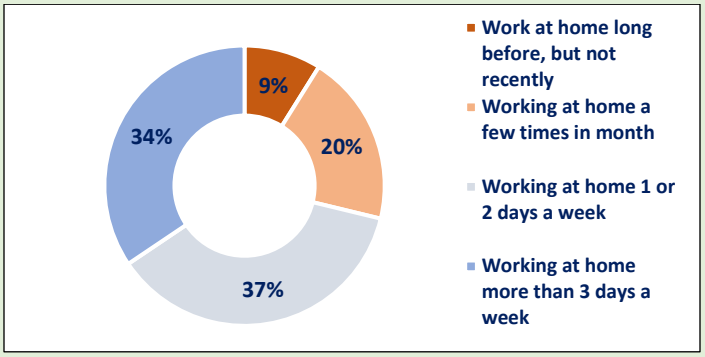


Figure 11 Telecommuting frequency before lockdown

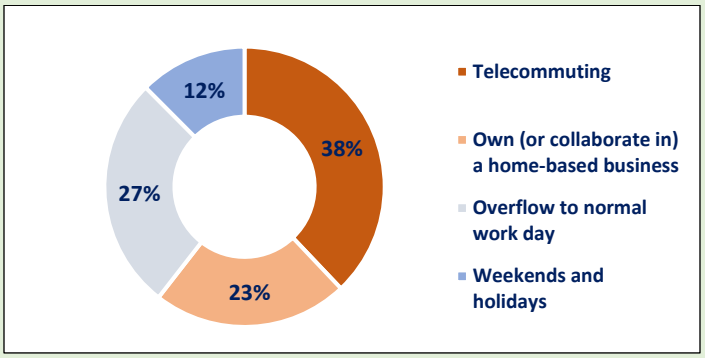


Figure 12 Distribution of different types of telecommuting before lockdown

Working at least one day from home	Before lockdown	During lockdown
	18.07%	34.94%
	14.20%	36.20%
	15.96%	35.63%

Work-related productivity, concentration, and cooperation

Between 40% to 50% of respondents stated no change in their performance, concentration, or collaboration with their colleagues compared to pre-COVID-19 (Fig. 13). However, the proportion of respondents who believes their productivity increased during the lockdown is 10.86% greater than those who were disadvantaged. Also, respondents found better ways to collaborate with their colleagues during the lockdown. 32.03% of them reported collaboration improvement, while 17.76% experienced an inverse impact. The lockdown condition was assumed more beneficial to the respondents for concentration.

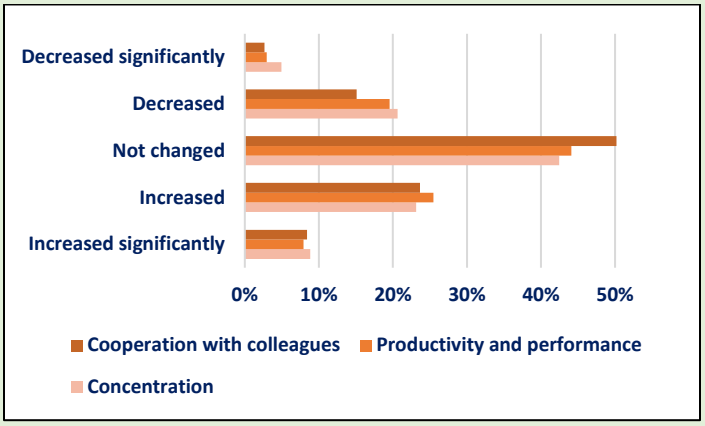


Figure 13 Compare the productivity measures before and during the lockdown

Stated Preference choice experiments

To observe respondents' activity preference under the given conditions, the stated choice of respondents was collected for two sets of scenarios, one for workplace choice and another for shopping method choice. For each activity, the set of 8 various scenarios from 24 generated cases was randomly selected and displayed. In the shopping method choices, e-shopping competes with two in-store shopping options. For workplace choice, the options are telecommuting, work at the usual workplace, and a combination of working at home and the workplace.

Choice sets

Shopping method choice

- E-shopping
- In-store shopping, super market
- In-store shopping, wholesale market

Workplace choice

- Working from home
- Working from workplace
- Hybrid workplace

Attributes

Shopping method choice

E-shopping	In-store shopping
Delivery time	One-way travel time
Delivery fee	Crowding level
Saving basket	Waiting time in line to enter
Risk of COVID-19	

Workplace choice

Work-from-home	Work at usual workplace
Facilities	One-way travel time
Furniture	Level of crowding
Shifting work hour	Shifting work hour
Splitting work hour	-
Risk of COVID-19	
Childcaring	

For e-shopping, in addition to delivery-related attributes (fee and time), there is the attribute of saving the basket from previous purchases to use in the next one. On the other side, for in-store shopping, the impact of travel time and waiting time to enter the store tested. To observe the reaction of respondents, two COVID-related attributes were included.

Attributes related to COVID-19

- Crowding level and the achievable social distancing
- Availability of vaccine and the proportion of people vaccinated

Available facilities (computer, internet, printer, and secondary monitor) and furniture (work desk/chair and office room) in addition to work flexibility (shifting start time and splitting work-hour) are the telecommuting specific variables. For work at the usual workplace, attributes are travel time, level of crowding, and shifting start time. Risk of COVID-19 and childcaring methods (at-home with/without a nanny and childcare) are two general attributes in these choice cases. Fig. 14 shows the distribution of workplace preference and experience teleworking. About 60% of respondents preferred work from home, although half of them had never experienced teleworking before COVID-19 lockdown.

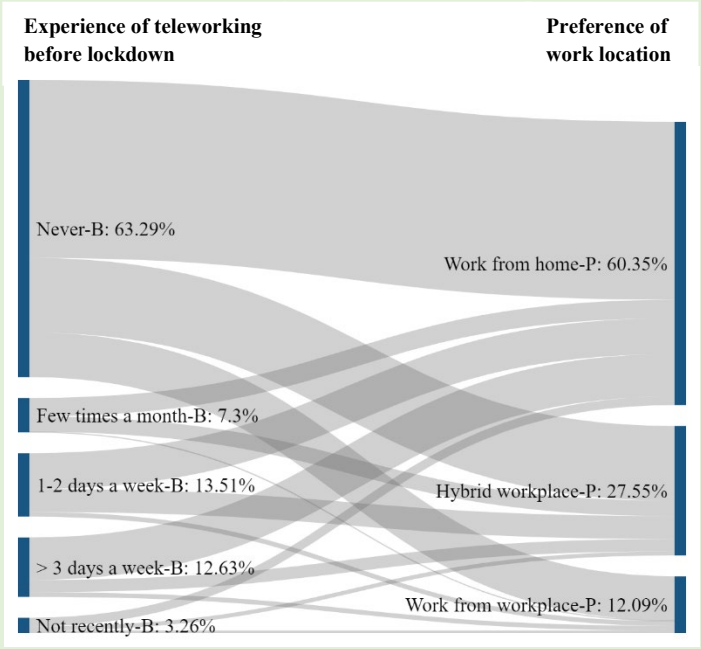


Figure 14 Comparing stated preference of work location and previous experience of teleworking before lockdown

Conclusion

Keys Statistics

88%	*believe **social-distancing** is essential to **control the spread** of the virus*
38%	*of employed respondents should **physically be at their workplace** during the lockdown*
91%	*of respondents reported more time spent **using internet** (among those reported change)*
62%	*believe **telecommuting** should be more common*
47%	*prefer **to visit workplace a few times a week** for various reasons even if they are allowed to telework*
52%	*prefere to have **fixed work-hour***

Conclusion

The main purpose of this study was to understand the impact of the COVID-19 lockdown on the activity-travel behaviour of GTA residents. To this end, the study seeks to find new activity-travel routines that emerged during the COVID-19 lockdown or shortly after reopening to anticipate the effects on long-term travel behaviour.

The focus of this study was on several frequent activities that repeat in the daily schedule of individuals (meal preparation/ eating, visiting, grocery and non-grocery shopping, and working).

The preliminary analysis shows immediate reaction for meal preparation/eating which didn't last after reopening. In contrast, online meetings for contacting friends and families emerged during the lockdown and, after reopening, continued as a new routine. Also, the online-ordering of groceries practiced by many respondents during the lockdown and found it beneficial to be continued. However, non-grocery shopping shows no particular trend in the short term.

Telecommuting also found as an appropriate substitute, especially for full-time workers. No matter the extent participants had done telecommuting before lockdown, it was stated the most attractive option. Teleworking was also found to have great potential to improve the concentration, productivity, and collaboration of workers.

Further detailed analysis is required to better understand the distribution of behaviour change through various groups with different characteristics. Also, to test the long-term changes in activity-travel behaviour, longitudinal data collection and monitoring are necessary. The findings help to develop insights about citizens' preference to substitute travel with alternative methods of doing activities. Thus, this will be a useful travel management tool in the hands of city planners and policymakers.

References

1. World Health Organization. WHO Timeline - COVID-19. Wold Health Organization. 2020 [cited 2020 Nov 26]. p. 2020. Available from: https://www.who.int/news/item/27-04-2020-who-timeline---covid-19
2. Mokhtarian P. If telecommunication is such a good substitute for travel, why does congestion continue to get worse? Transportation Letters. 2009 Jan 7;1(1):1–17.
3. List of municipalities in the Greater Toronto Area - Wikipedia. [cited 2020 Nov 26]. Available from: https://en.wikipedia.org/wiki/List_of_municipalities_in_the_Greater_Toronto_Area#/media/File:Greater_toronto_area_map.svg
4. Census Profile, 2016 Census - Toronto [Census metropolitan area], Ontario and Ontario [Province]. [cited 2020 Nov 26]. Available from: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CMACA&Code1=535&Geo2=PR&Code2=35&SearchText=Toronto&SearchType=Begins&SearchPR=01&B1=Labour&TABID=1&type=0
5. COVID-19 POLICY TIMELINE - The Ontario Federation of Labour. [cited 2020 Nov 26]. Available from: https://ofl.ca/covid-19-policy-timeline/
6. Archived - Reopening Ontario in stages. [cited 2020 Nov 26]. Available from: https://www.ontario.ca/page/reopening-ontario-stages