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Authors

Pezeshknejad, Parsa
Palm, Matthew
Rowangould, Dana

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Parsa Pezeshknejad, University of Vermont

Matthew Palm, University of North Carolina at Chapel Hill

Dana Rowangould, University of Vermont

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16. Abstract
The Covid-19 pandemic significantly impacted transit ridership across Canada. As the pandemic begins to subside, understanding the factors that influence peoples' decisions to use transit (or not) is crucial for the recovery and long-term sustainability of public transit. Using data from the third wave of the Public Transit and Covid-19 survey in Canada, this study evaluates who returned to pre-pandemic transit use, the factors influencing the decision to ride transit, and peoples' intentions for future transit use. The authors find that most transit riders perceive that the pandemic is over but its effects are here to stay, though they are split about whether the pandemic still affects their transit use. While some transit riders have gradually returned to pre-pandemic transit levels, a relatively small share of those who have not yet fully returned intend to and a significant proportion do not intend to fully return. About half of transit riders will return to transit at a lower usage level than before the pandemic, while about 10% do not intend to return at all. The results indicate that in the "new normal", transit use will remain below pre-pandemic levels for those who rode transit before the pandemic. Factors such as car access are significantly related to the extent to which people have returned to transit, although this may be reflecting a shift away from transit rather than causing the shift. Factors such as easy access to transit stops, service frequency, and proximity to home and job locations influence current transit use.

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Transit Use During and After the COVID-19 Pandemic: The "New Normal" for Public Transit Ridership

Parsa Pezeshknejad
Civil and Environmental Engineering
University of Vermont
Burlington, VT 05405
Parsa.pezeshknejad@uvm.edu

Matthew Palm
Department of City and Regional Planning
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599
palmmatt@unc.edu

Dana Rowangould (corresponding author)
Civil and Environmental Engineering
University of Vermont
Burlington, VT 05405
dana.rowangould@uvm.edu

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ABSTRACT

The Covid-19 pandemic significantly impacted transit ridership across Canada. As the pandemic begins to subside, understanding the factors that influence peoples' decisions to use transit (or not) is crucial for the recovery and long-term sustainability of public transit. Using data from the third wave of the Public Transit and Covid-19 survey in Canada, we evaluate who returned to pre-pandemic transit use, the factors influencing the decision to ride transit, and peoples' intentions for future transit use. We find that most transit riders perceive that the pandemic is over but its effects are here to stay, though they are split about whether the pandemic still affects their transit use. While some transit riders have gradually returned to pre-pandemic transit levels, a relatively small share of those who have not yet fully returned intend to and a significant proportion do not intend to fully return. About half of transit riders will return to transit at a lower usage level than before the pandemic, while about 10% do not intend to return at all. Our results indicate that in the "new normal", transit use will remain below pre-pandemic levels for those who rode transit before the pandemic. Factors such as car access are significantly related to the extent to which people have returned to transit, although this may be reflecting a shift away from transit rather than causing the shift. Factors such as easy access to transit stops, service frequency, and proximity to home and job locations influence current transit use.

1. INTRODUCTION

In the past three years, the Covid-19 pandemic has had pervasive impacts on public health, the economy, people's ability to socialize, and their well-being. During the first stages of the pandemic, transit ridership throughout the United States declined drastically (*1*). Canada also experienced a drop in transit ridership of approximately 75% ridership compared to pre-pandemic levels (*2*, *3*). The decline in transit ridership during the pandemic can be attributed to pandemic-related changes such as fear of Covid-19 (3), policy restrictions, decreases in services offered, car ownership, being an essential worker (*4*–*7*). Pandemic job losses and telecommuting options have also caused many people to stop using transit (*8*, *9*). Reductions in transit use impacted peoples' travel behavior, health, economic activity, and the ability to get to work (*10*). Many of these impacts have been most sharply felt among people with lower income, essential workers, and those who rely on transit (*11*, *12*).

The advent of vaccines and their widespread dissemination has led to a decline in Covid-19 cases and lifting of restrictions in many regions, providing some hope for a return to relative normalcy. But while many people have returned to transit, there remains a persistent reduction in transit use in many regions. In both Canada and the US, transit ridership remains under 75% of its pre-pandemic levels (*13, 14*).

With reduced ridership, many transit agencies are also faced with declining revenue. This can limit the service they can provide, further undermining ridership. Given the critical mobility that transit systems provide (particularly for those with limited resources), understanding and addressing ridership declines spurred by Covid-19 is crucial. It requires understanding why many transit riders have not returned to public transit and opportunities and barriers to bring former riders back.

Research on the effect of the Covid-19 pandemic on transit use have primarily focused on understanding which individuals were more affected and the factors that have contributed to the decline in transit ridership (*12, 15–20*). However, as the Covid-19 pandemic wanes, it is important to understand the extent to which ridership will (or will not) return to pre-pandemic levels and the factors and actions that will bring more riders back.

This study aims to contribute to the growing body of literature focused on understanding the future of public transit use in the post-pandemic "new normal" era. We use a panel survey of transit riders in two Canadian cities to address three questions. First, we evaluate the factors that influence peoples' decision to return (or not) to their pre-pandemic levels of transit use. Second, we identify the barriers preventing people from returning to their pre-pandemic transit use. Third, we investigate whether those who have not returned to transit intend to return to or not, and why. We evaluate these questions using the third round of a panel survey of transit riders in Toronto and Vancouver, Canada. Our findings shed light on potential strategies and interventions to attract transit riders back to transit in order to ensure the long-term viability of transit systems.

2. LITERATURE REVIEW

2.1 Covid-19 effects on travel behavior

The Covid-19 pandemic had profound effects on travel behavior. Implementing lockdown measures during the pandemic impacted both transit users and non-transit users (*15*, *21*). It affected individual trips and profoundly affected overall travel activity and mode choices such as avoiding non-essential trips or switching to cars (*22*). Studies have shown that the pandemic resulted in significant changes in travel behavior, including reduced overall trip-making frequency, changes in trip purposes, and altered travel preferences (*15*). For instance, implementing lockdowns, social distancing measures, and remote work arrangements decreased overall travel activity as people confined their movements to essential trips only

(*5*, *10*). Even after lockdowns and end of the pandemic, changes that have resulted from remote working may persist (*23*). Over the long term, it is important to identify what changes in travel behavior might continue. For example, avoiding non-essential leisure trips is only short-term (*22*).

2.2. Covid-19 effects on transit ridership

Covid-19 has tested the resilience of public transit systems in terms of both the pandemic itself as well as post-pandemic recovery (*1*). In the early stages of the Covid-19 pandemic, transit ridership in Canada and the US plummeted (*1*, *13*). As the pandemic has waned, transit ridership remains diminished, hovering below 75% of pre-pandemic levels (*13*, *14*). Several Covid-related factors have influenced transit ridership.

2.2.1. Fear of covid

During the height of the Covid -19 pandemic, fear of contracting the virus was an important factor influencing reduced transit usage. Previous research highlighted the correlation between transportation and the spread of Covid -19, indicating that higher levels of travel and increased trip frequency contribute to the transmission of the virus (*19*). Research has shown that factors like vulnerability, perceived risk, and fear of Covid play a significant role in adopting preventive behaviors during a pandemic (*4, 24*). Those who adopt preventive measures may choose to avoid public transportation altogether, contributing to reduced transit usage. Basu et al. (2021) investigated perceptions of non-transit mobility options in the Boston area during the pandemic. They found that car commuters and other mode commuters perceive taxies as unsafe, and view private vehicles as a better commuting option (*25*). A US study revealed that levels of perceived risk vary between people and is tied to transit ridership (*24*). Individuals who recovered from COVID-19 show less concern and have more transit use. Travelers who identify as women experienced significantly higher levels of worry, as did members of households in which an individual is Covid-vulnerable. At the same time, across all transit modes, mask-wearing and social distancing measures significantly decrease riders' worry of infection (*24*).

Policy strategies that seek to limit contact (and therefore Covid-19 exposure) on transit may unintentionally deter transit use to the extent that people avoid transit due to perceived disease risk, as they highlight the risks on transit. While some restrictions were eventually lifted to encourage the resumption of economic activity, the revival of transit ridership may not occur as quickly due to the lingering concerns and perceived risks (*5*). It is unknown whether concerns associated with Covid-19 exposure will continue to affect transit ridership in the longer term as the pandemic subsides.

2.2.2. Changes in employment, schooling, and childcare

Job loss during the pandemic is another significant phenomenon that may affect transit use (*26*). Angelucci et al. (2020) observed that job losses were almost three times higher among non-remote workers. Similar findings were observed in U.S., U.K. and Germany (*5*). Job losses may affect transit use when transit commute trips are eliminated. Job losses also bring a loss in income, which can affect transit use if people reduce how much they travel in general or if transit fares become a barrier to transit travel.

Telecommuting, or remote work, has emerged as a significant factor contributing to reduced transit use during the pandemic. As individuals transitioned to remote work, their need to commute to workspaces decreased, resulting in a decline in transit ridership. The growth in remote work has raised questions regarding the distribution of benefits and drawbacks across different socio-economic groups, as some individuals have greater access to remote work opportunities than others. Several studies examined the ability to telework within the community (*23*, *27*, *28*). Some evidence suggests that teleworking is a

privilege of higher-income jobs. Brynjolfsson et al. (2020) found that 35% of commuters could switch to teleworking, and younger people were more likely to switch to remote working (*28*).

2.2.3. Alternative modes and car ownership

The pandemic has brought about changes in the modes that people use. People who relied heavily on public transit as their primary mode of transportation before the pandemic shifted towards alternative modes, such as private vehicles or active transportation modes if the neighbourhood was walkable, due to concerns such as infection risks or changes in work arrangements (*6, 17*).

Modes such as bike-share have demonstrated resilience. Teixeira and Lopes (2020) examined the relationship between subway use, bike share and Covid-19 cases and revealed that bike-share experienced a less significant decline (71%) compared to the subway system (90%) in New York City (*29*). Some people have shifted towards active transportation modes such as walking or cycling for short-distance trips (*9*). This improves the health and sustainability of travel and reduces the reliance on private vehicles, but may also draw riders from public transportation.

The convenience and accessibility of driving (such as ample street networks and free parking spaces) outweigh the alternative modes of transportation, making it difficult for public transit to compete. Not surprisingly, car ownership has also played a role in pandemic-era transit use. A study of transit use during the pandemic in Canada revealed a decline in transit ridership and a lower desire to return to transit among individuals with alternative transportation options, such as car owners (*6*).

2.2.4. Costs

One of the factors influencing transit ridership changes in general is the cost associated with transportation options. Using regional household travel survey data in Atlanta, Ghimire and Lancelin, (2019) found that employees who were provided with free or subsidized transit pass were 156% more likely to commute on transit (*30*). Additionally, the price of gasoline has been found to have an impact on short-term changes in transit ridership. Research conducted in the United States and Germany shows that a drop in gasoline prices is typically associated with decreased transit ridership (*31, 32*).

2.2.5. Transit service changes

The Covid-19 pandemic significantly impacted public transit systems, leading to profound changes in service such as service cuts and subsequently affecting transit ridership. Service reductions were adopted for several reasons, including adherence to guidelines focused on mitigating transmission, in response to staffing shortages associated with the pandemic, as well as to compensate for the loss in fare revenue (*33*). Transit agencies in major Canadian cities, including Toronto and Vancouver, implemented several measures in response to the Covid-19 pandemic, including service reductions, changes in transit vehicles, back door boarding, and providing free masks and sanitizers. Notably, cities with higher ridership levels, such as Toronto and Vancouver, implemented a relatively high number of these measures compared to other Canadian cities (*34*).

Changes in service, such as fares, hours of service, service frequency, safety, and geographic coverage can affect transit ridership. Studies suggest that service cuts implemented during the pandemic may have contributed to reductions in transit use (*12*). The decline in transit use results in decreased revenues, exacerbating the financial strain faced by transit agencies and compelling many agencies to implement service reductions which in turn act as a further disincentivize to use transit use (*35*).

2.2.6. Sociodemographics

Population characteristics such as race and ethnicity, age, and immigrant status are also related to changes in transit ridership. The experiences of different transit riders vary depending on their situational contexts, individual resources, needs, and identities (*6*, *12*, *17*). Younger people and women tend to report higher levels of preventive behavior regarding Covid-19 and are more likely to stop using transit during the pandemic (*4*). Some groups, such as individuals with disabilities and those living below the poverty threshold, continue to rely on transit while female riders are less likely to use transit during the pandemic(*12*). Recent immigrants are more likely to forgo public transit and move towards vehicle ownership due to the pandemic (*6*).

2.3. Research gap: persistence of transit ridership impacts in the future

It is unknown whether and to what extent the pandemic will have long-lasting effects on public transport systems. A study in the U.S. estimates that the pandemic's long-term impacts may result in a decline in transit use of approximately 40% as many transit riders shift away from transit toward cars, bikes, or telework (*9*). In light of the critical role that transit systems play in supporting sustainability and equity objectives, the prospect of a dramatic and sustained contraction in transit systems points to the need to understand the actions that can be taken to minimize the long-term effect of the pandemic on transit ridership.

Understanding variation in who left transit and who has returned sheds some light on the nature of current and future ridership losses. Undoubtedly, ridership has changed during the pandemic, and the magnitude differs among different social groups. Studies show that ridership changes have varied greatly between different demographics and neighborhoods (*12*, *17*, *18*).

Early indications suggest that specific groups are more or less likely to return. For example, to the extent that teleworking persists, the associated commute trips will not return to transit. Palm, (2022) found that residing in a neighborhood with good pre-Covid-19 transit accessibility reduces the likelihood of individuals expressing their intention to decrease transit usage post-pandemic (*6*).

Based on the literature on transit use in general as well as during the pandemic, we posit that as the pandemic continues to wane, people's decision to return to transit is influenced by many factors, including access to alternative transportation options, financial resources, their reliance on transit before the pandemic as well as the quality of transit services in their community.

While previous research has investigated the declining trend in transit service, ridership, and changes in mobility patterns, little is known about why some people have returned to transit after they cut or reduced their transit use, while others have not. For those who have not returned, we are also interested in the actions that agencies can take to draw them back. Understanding the underlying mechanisms that drive the choice to return to transit as well as the policy actions that can encourage a return to transit is crucial for ensuring the viability of transit systems in the future.

3. METHODS

3.1 RESEARCH QUESTIONS

We investigate factors influencing individuals' decisions to return to their pre-pandemic levels of transit. We focus on three research questions. First, we evaluate who has returned to their pre-pandemic transit use and who has not. Second, we evaluate the reasons behind their decision to return (or not). Finally, we evaluate peoples' intention to return to transit (or not) in the future.

3.1. Data Collection

The data for this study come from the third wave of the Public Transit and Covid-19 panel survey conducted in Toronto and Vancouver. The original survey targeted residents in Toronto and Vancouver, Canada, who rode transit more than once a week prior to the Covid-19 pandemic. The initial survey was conducted in May 2020, as documented in previous studies(*17*, *36*), while the second survey took place in March 2021, as reported in recent publications (*6*, *37*). Initial recruitment in the first wave was carried out through social media platforms including Facebook. The data collected successfully reproduced known relationships between travel behavior and demographics in Toronto, although comparison data for Vancouver was unavailable (*36*).

The third wave was conducted in September and October 2022, capturing 1140 respondents (Figure 1). The third wave was administered in Qualtrics and included measures to prevent bot responses (requirements were unique IP addresses, a CAPTCHA, and a question to ensure they pay attention). Through data cleaning processes, participants who provided erroneous responses were eliminated. Individuals who did not respond to the main questions used as outcomes or independent variables were also excluded. It is important to note that the representativeness of the data may have been affected by attrition. To address this issue, we apply IPW (Inverse Probability Weighting) weighting to account for the loss of participants, as discussed further below.

To assess our research questions, we measured four outcomes: change in transit use (current use relative to transit use before the pandemic), reasons for using transit (or not), sentiments toward Covid-19, and intentions for future transit use. We also measured several independent variables capturing people's personal circumstances (including socio-demographic factors and car ownership) as well as the built environment (including transit accessibility to work or grocery stores) at their home location. We examine the relationships between these variables to gain insights into the factors influencing individuals' decisions and attitudes regarding transit use during and after the Covid-19 pandemic. Table 1 summarizes attributes of survey respondents.

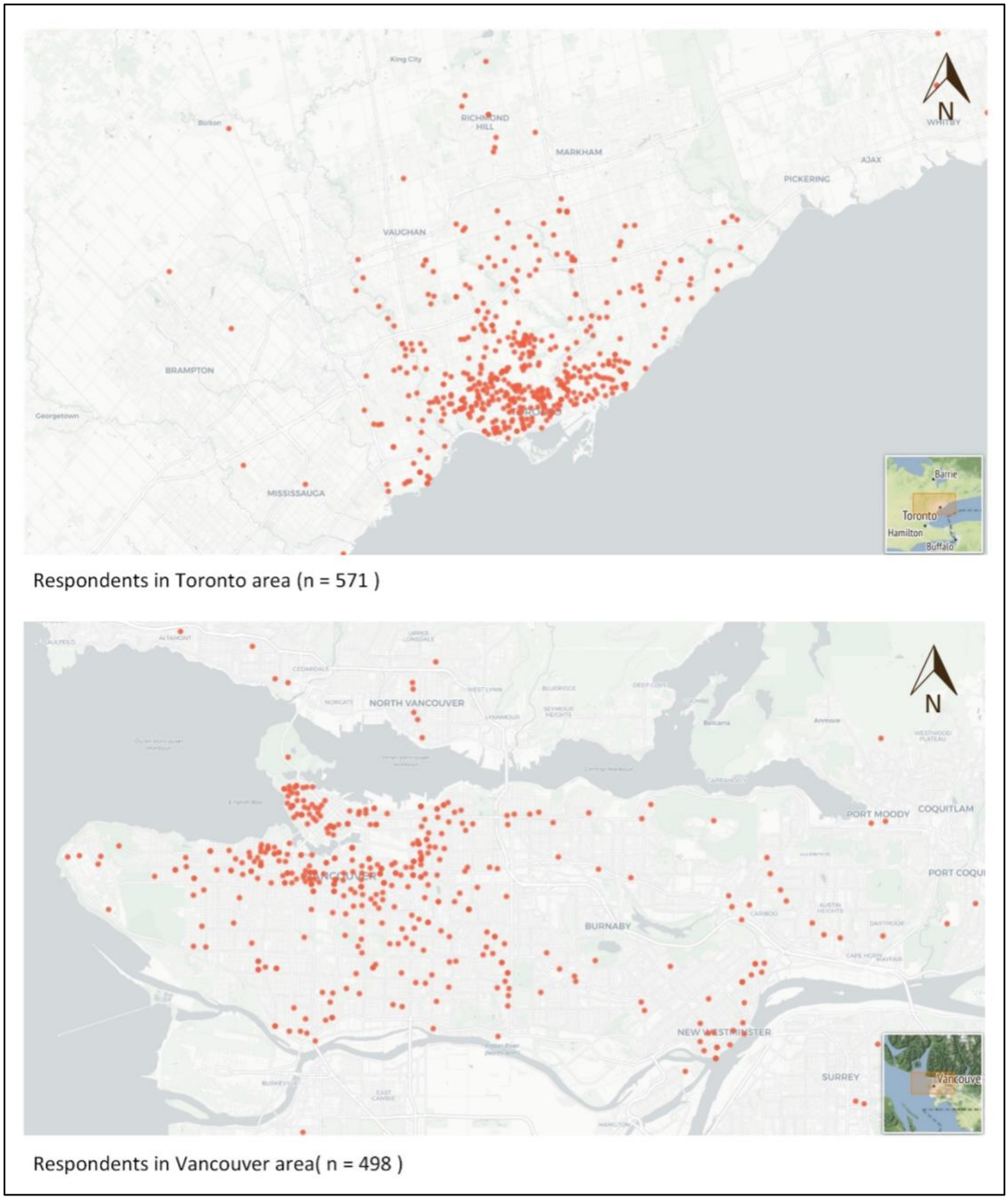

Figure 1. Map of respondents' dissemination areas in Toronto and Vancouver

Table 1. Summary of respondents' characteristics

Dependent Variables	**Categories/Grouping**	**Mean**	**SD**
Change in transit use	Percent relative to pre-pandemic	66	85
Independent Variables	**Categories/Grouping**	**n**	**%**
City	Toronto	571	53%
	Vancouver	498	47%
Car Access	No Access	369	35%
	Owner	448	42%
	Shared Access or other	252	24%
Car access change	Less Access	36	3%
	More Access	147	14%
	No change	886	83%
Age	18-29	326	30%
	30-49	303	28%
	40-64	354	33%
	65+	86	8%
Gender	Female	698	65%
	Male	283	26%
	Non-binary	88	8%
Disability	No	1035	97%
	Yes	34	3%
Income for wave 3	Low (<$40,000)	230	22%
	Middle ($40,000-$79,999)	353	33%
	High ($80,000-$124,999)	220	21%
	Very High (>$125,000)	151	14%
	Did not mention	106	10%
Children	No	918	86%
	Yes	151	14%
Adults	1	241	23%
	2	203	19%
	3	412	39%
	4+	213	20%
Ethnicity	Asian	120	11%
	People of color (POC)[1]	208	19%
	White	741	69%
Employment	Blank	18	2%
	Employed	895	84%
	Not employed	156	15%
Employment change	Got a job	221	22%
	Lost a job	25	2%
	No change	767	76%
Have had Covid-19	No	379	35%
	Yes	690	65%
Built-environment Variables		**Mean**	**SD**
Access to jobs by transit		0.44	0.03
Access to grocery stores by transit		9.68	0.284

[1] People of color include multiple ethnicities, Black, Indigenous, and Latin American.

3.2. Outcome variables

We use three key types of dependent variables corresponding to each research question. First, we estimate the change in transit use relative to pre-pandemic as the percent change in weekly transit trips (ascertained by asking respondents to indicate the number of trips taken in the past week (wave 3) and the typical weekly transit use before the pandemic (wave 1). This variable allows us to identify the extent to which individuals have resumed their regular transit use and provides a quantitative measure of the extent to which they have returned to pre-pandemic ridership.

Second, to measure the factors influencing individuals' decisions about their transit use, participants were asked "How important are each of the following factors in your decision about how much you use transit?", from "very important" to "not important". These factors include attributes of transit systems (including transit reliability, accessibility, convenience, cost, safety, and environmental concerns) as well as other factors that may influence transit use such as availability of alternative modes of transportation, life changes, and more.

Finally, to capture respondents intentions for future transit use as the pandemic wanes, we asked participants: "If in 6 months the Covid-19 pandemic is over, how often would you use transit compared to how much you use it now?" with response options indicating how often they will use transit relative to their current transit use. To evaluate whether and when we may observe a post-pandemic shift to a "new normal" and what transit use may look like in a "new normal", we also ask whether the pandemic is over, whether their transit use and day-to-day life is still affected by the pandemic, and if they think the Covid-19 pandemic effects are here to stay.

3.3. Independent variables

We use a set of independent variables to investigate our research questions and factors relating to outcomes. We ascertain demographic characteristics such as city (Toronto, Vancouver), age, gender, income in the third round of survey, income change compared to pre-pandemic, ethnicity/race, number of people in the household, presence of children, employment and employment change compared to pre-pandemic, car access and car access change compared to pre-pandemic. The also measure car access and changes in car access relative to pre-pandemic. In addition, the study explores health-related factors, including a binary variable for respondents who had COVID-19 and disability (Table 1).

3.3.1 Built environment

In addition to the data collected through the Public Transit and Covid-19 Survey, we also used built environment data obtained from the government of Canada (*38*). This data includes accessibility indices that measures the level of accessibility to several types of destinations using different modes of transportation, including transit, walking, and biking. We use the transit access to jobs and grocery stores, which are estimated as indices using a gravity model. Further information on the metrics can be found on Statistics Canada's website (*38*). The indices are calculated at the Dissemination Block scale, so we aggregated these values up to the Dissemination Area level (DAs) through a population weighted average to join them to our survey data.

3.4 Data analysis

We use summary statistics, data visualization, and statistical comparisons between groups to analyze the relationship between these factors and transit usage. To evaluate research question 1 (who has returned to transit), we visualize differences across groups using box plots, and we evaluate these differences using statistical tests for pairs of groups (Wilcoxon rank sum tests). In our evaluation of both research questions

1 (who has returned to transit) and 3 (intention to return to transit), we visualize summary statistics using Sankey plots, which show the flow and distribution of responses between different categories or stages.

To evaluate research question 2 (reasons for transit use), we use diverging bar plots to visualize the level of importance of each reason and multivariate modelling to analyze the relationship between the extent to which people have returned to transit. This helped us gain insights into which factors were most influential in determining peoples' likelihood of returning to their pre-pandemic levels of transit use. We use Ordinary Least Squares (OLS) linear regression to evaluate the continuous outcome variable (percentage of pre-pandemic transit trips). The model was performed both with and without inverse probability weighting (IPW) to account for potential biases caused by attrition.

3.5.1. IPW Weighting

In our study, we employ the method of Inverse Probability Weighting (IPW) to account for the potential loss of participants and ensure the representativeness of our analysis in the multivariate modeling and summary statistics. IPW is a statistical technique used in survey research to address attrition issues (*39*). IPW is particularly relevant in our study because we conducted multiple waves of data collection, and some respondents dropped out over time, leading to a potential bias in terms of who responded in the third wave of the survey. By applying IPWA, we can adjust the weights of the remaining respondents to compensate for the non-response and make the analysis more representative of the target population. To calculate the weights, we identify the predictors from previous waves (wave 1) relevant to our models and then we used the IPW package in R to estimate the propensity scores, compute inverse probability weights, and normalize weights.

4. RESULTS

4.1 RQ1: Who has Returned to Transit?

First, we examine the trend of transit use changes from the pre-pandemic period to the present, using Sankey diagrams (Figure 2). Notably, nearly 70% of respondents stopped using transit at the beginning of the pandemic, and by March 2021 (a year into the pandemic), only 9% of individuals had returned to pre-pandemic transit use or more. In September 2022 (two and half years after the initial pandemic lockdowns), less than a quarter have returned to their pre-pandemic transit levels or more, although 98% are vaccinated. The share of respondents who have stopped using transit has decreased over time, but approximately 20% continue to forego transit trips.

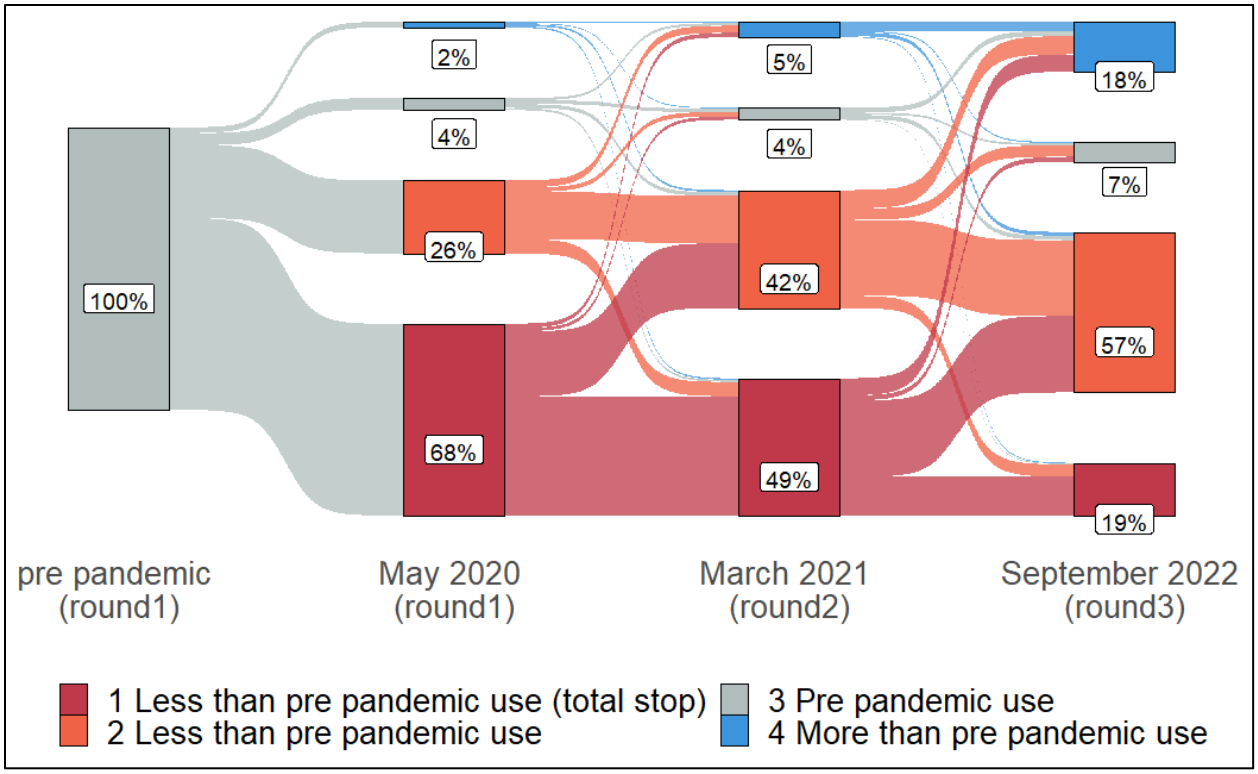

Figure 2. Weighted Sankey diagram of changes in transit use relative to pre-pandemic for all 3 survey waves

We also evaluate differences in the return to transit for those who currently have access to a vehicle and those who indicate that their transit use is still affected by the pandemic (Figure 3). For each box plot, the pairwise Wilcoxon test is shown on the plots. Those with better access to a vehicle show a significantly lower percentage of pre-pandemic transit use when compared to those with less access or no access. Those who reported being still affected by the pandemic showed lower return to pre-pandemic transit use than those who feel they are no longer affected or are unsure. These findings highlight the pandemic's continued influence on some peoples' transit behavior and the importance of addressing the factors contributing to the ongoing decline in transit use.

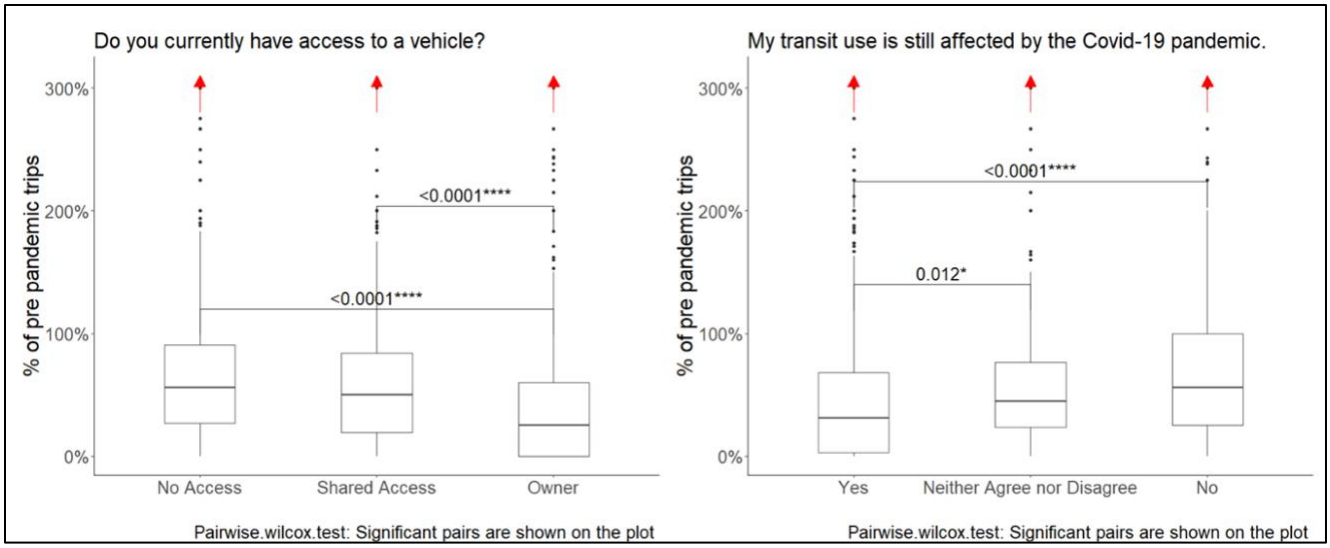

Figure 3. Box plots of current transit use versus vehicle access (left) and if transit use is still affected by Covid-19 (right), red arrows indicate more outliers above

4.2. RQ2: Reasons People Use Transit

Next, we used multivariate models to estimate the effects of our predictors on the extent to which people have returned to their pre-pandemic transit use (Table 2). The regression models include factors related to demographics, built environment characteristics, and changes in variables over time, such as changes in car access. We also include a location variable in our models to control for differences in each city.

Table 2. Multivariate modeling of change in transit use (% of pre-pandemic transit use)

Variables	Unweighted model		Weighted model	
	Coefficient	p-Value	Coefficient	p-Value
Intercept	46.7	**0.018**	47.7	**0.018**
City (ref: Toronto)				
Vancouver	19.6	**0.001**	21.8	**0.001**
Age (ref: 18-29)				
30-49	2.8	0.704	4.2	0.571
40-64	10.4	0.173	11.3	0.148
65+	23.3	**0.065**	21.6	0.127
Gender (ref: Male)				
Female	-10.7	0.095	-8.1	0.211
Non binary	0.7	0.945	0.9	0.934
Ethnicity (ref: White)				
Asian	6.2	0.502	9.5	0.237
People of color (POC)[1]	21.8	**0.002**	24.6	**0.001**
Adults in the house hold (ref: One)				
Two	-4.1	0.624	-5.3	0.554
Three	9.3	0.217	10.1	0.212
Four and more	10.3	0.247	13.1	0.150
Have children	-0.9	0.909	-4.1	0.620
Disabled	-39.2	**0.012**	-44.7	**0.002**
Had Covid-19	15.1	**0.010**	10.8	**0.079**
Employed	-2.6	0.793	-6.8	0.522
Employment change (ref: no change)				
Got a job	25.8	**<0.001**	28.5	**<0.001**
Lost a job	-0.9	0.961	4.4	0.832
Income for wave 3 (ref: Low (<$40,000))				
Middle ($40,000-$79,999)	0.4	0.959	-1.4	0.853
High ($80,000-$124,999)	7.1	0.430	5.7	0.538
Very High (>$125,000)	-14.7	0.150	-16.0	0.133
Did not mention	-7.8	0.465	-6.7	0.537
Car access (ref: No access)				
Owner	-22.4	**0.002**	-23.8	**0.001**
Shared access or other	10.0	0.179	-7.0	0.366
Car access change (ref: no change)				
Less access	18.6	0.203	17.2	0.262
More access	-14.3	**0.099**	-15.4	**0.080**
Employment access index[2]	4.3	0.825	4.1	0.843
Grocery access index[2]	-0.02	0.963	0.03	0.951
Observations	912		912	
R^2	0.090		0.113	

[1] People of color include multiple ethnicities, Black, Indigenous, Latin American.
[2] The indices are for transit

The model without weighting indicates several significant predictors, and coefficient estimates are consistent between the weighted and unweighted models, except for the effect of being aged 65 or older. Both models indicate that people living in Vancouver have significantly higher transit trips relative to their pre-pandemic levels when compared to those living in Toronto. As we might expect, people whose

car access increased relative to pre-pandemic and those with access to a personal vehicle have lower transit use relative to their pre-pandemic level of use. Obtaining a job is associated with higher levels of transit use relative to pre-pandemic, which may reflect greater need to travel or greater financial means. Having had Covid-19 is also related to higher transit use relative to pre-pandemic levels, which may be related to feelings of caution or fear of exposure. People of color also show higher transit use relative to pre-pandemic when compared with transit use of white people. People with disabilities report less recovery compared to those without disabilities. The weighted model has a slightly better model fit (R^2) than the unweighted model.

We also evaluate the importance of various factors in individuals' decisions about their transit use. We evaluate personal and external factors and transit system attributes (Figure 4). Among personal and external factors, the most influential factors are how easy it is to get to a transit stop, how often people travel, their home location, and if they are carrying cargo. The safety of reaching transit stops and their job location are highly influential factors (Figure 4). Overall, it appears that factors directly related to transit accessibility and convenience play a more significant role in shaping individuals' decisions to use transit.

Interestingly, factors related to driving, such as the price of gas, giving a ride, ease of driving, and access to a car, were among the least important factors cited by people about their transit decisions. This suggests that these driving-related factors have a relatively minimal impact on individuals' choices regarding transit use. Combined with the findings from the multivariate modelling, it suggests that the relationship we observe between transit use and vehicle access may indicate that decisions about transit use cause decisions about vehicle access (rather than the opposite).

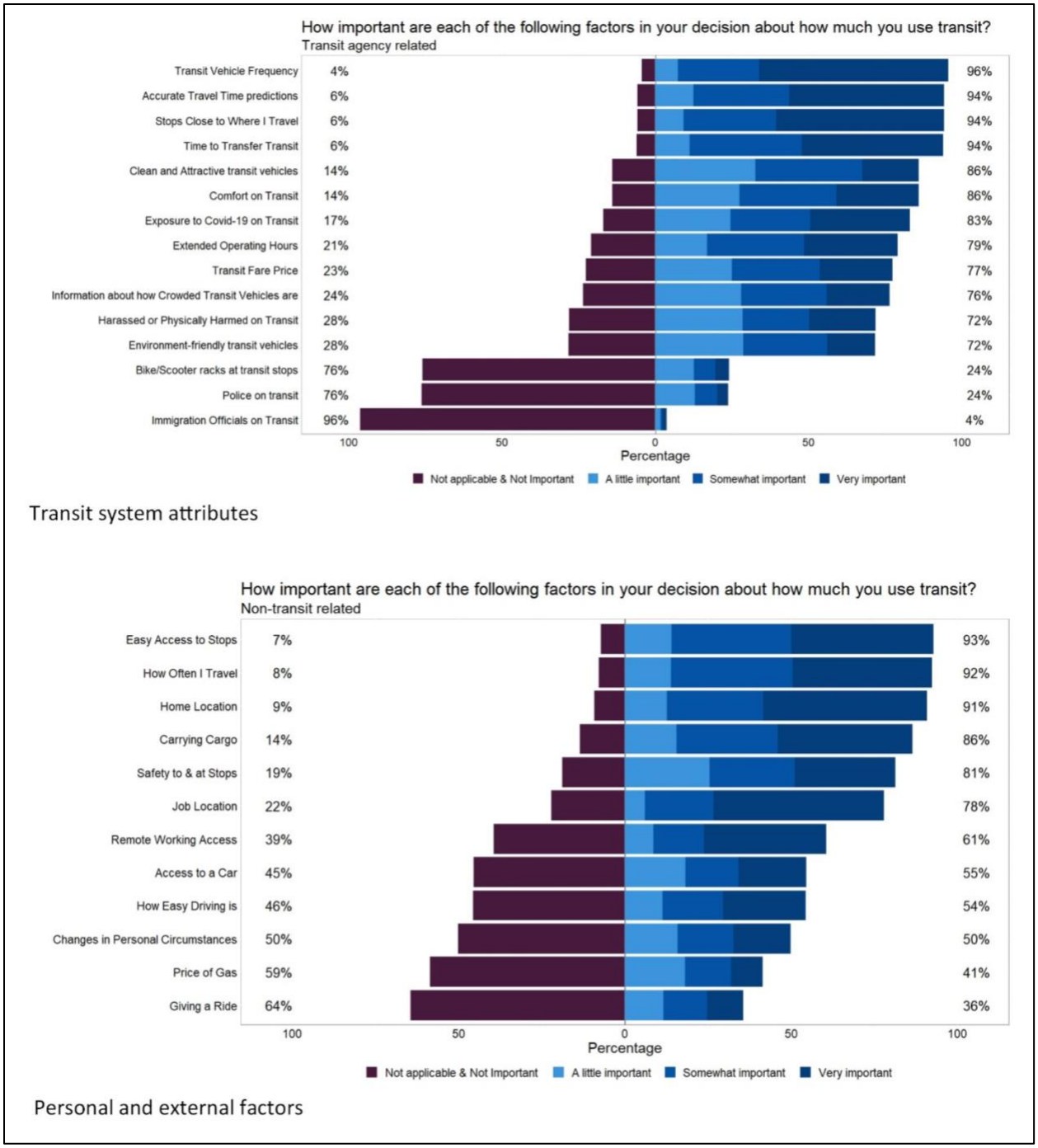

Figure 4. Importance of factors in decision to use transit

Looking at factors related to transit system attributes (Figure 4), the most important factors appear to be as important as or slightly more important than the most important personal and external factors (Figure 4). The most important transit service factors include the frequency of vehicles, the accuracy of travel time predictions, the proximity of stops to destinations, and the time to transfer to another route. Extended operating hours, transit fare prices, and information about crowding on transit vehicles were also ranked moderately high in importance. This suggests that individuals value reliable and efficient travel experiences when using public transportation. Other factors that ranked moderately high in importance

include the cleanliness and attractiveness of transit vehicles, the level of comfort on transit journeys and exposure to Covid-19 on transit, and concerns about harassment or physical harm on transit, all reflecting the quality of the experience of being on transit. In contrast, most stated that bike/scooter racks at stops, police on transit, and immigration officials on transit are not important factors. These findings indicate that transit agencies should focus on enhancements such as the frequency of vehicles, the proximity of stops, and the reliability of arrival times to attract and retain transit ridership.

4.3. Intention to Use Transit in the Future Transit Use (What is the New Normal?)

We first evaluate peoples' overall sentiments toward the Covid-19 pandemic and how it influences their daily lives and transit use (Figure 5). Interestingly, most respondents indicate that the pandemic is over (78%) and that their day-to-day life is no longer affected (63%), but also that the effects of the pandemic are here to stay (77%). Respondents are largely split on whether their transit use is still affected by the pandemic, with more reporting that it is (51%) rather than that it is not (34%). Overall, these results suggest that the lingering effects of the pandemic may shape the "new normal" of transit use, and efforts to restore and rebuild transit ridership to pre-pandemic levels require additional insight into why some have chosen to remain off transit.

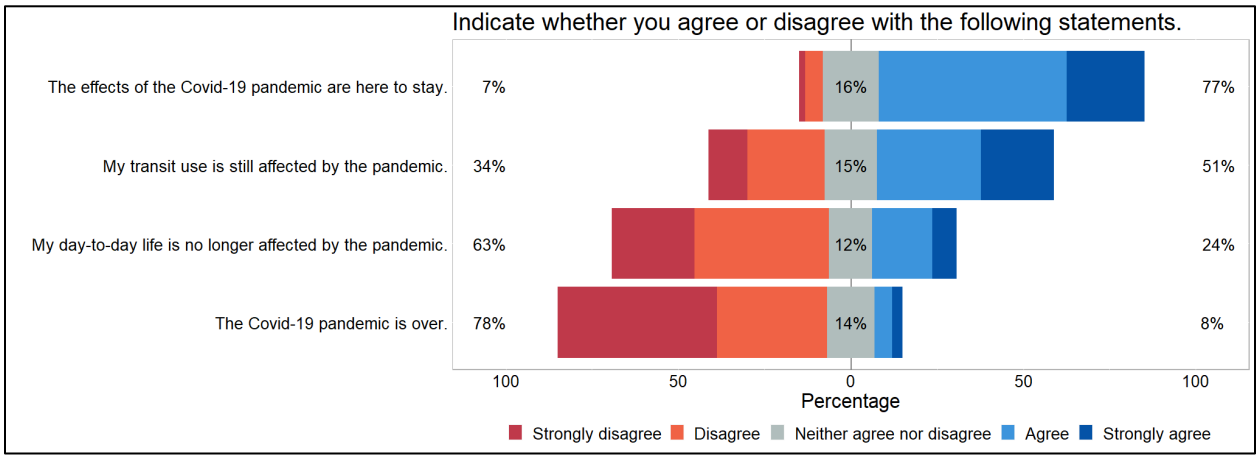

Figure 5. Sentiments about COVID-19 pandemic

Peoples' current transit use (relative to pre-pandemic) and intentions about future transit use relative to their September 2022 transit use are visualized in Figure 6. Just over a quarter of respondents expressed their intention to use transit more often in the future when the pandemic is over compared to their September 2022 usage, largely reflecting a shift to increasing transit use for those who have not yet returned to their pre-pandemic usage as of September 2022. At the same time, a majority of respondents (63%) indicated that they would use transit about the same amount as they did when asked in September 2022, and most of these respondents are still below their pre-pandemic use or have completely stopped using transit. This suggests that we may be headed for a "new normal", wherein a subset of those who have not yet fully returned are planning to return, but most of those who have not fully returned do not intend to return.

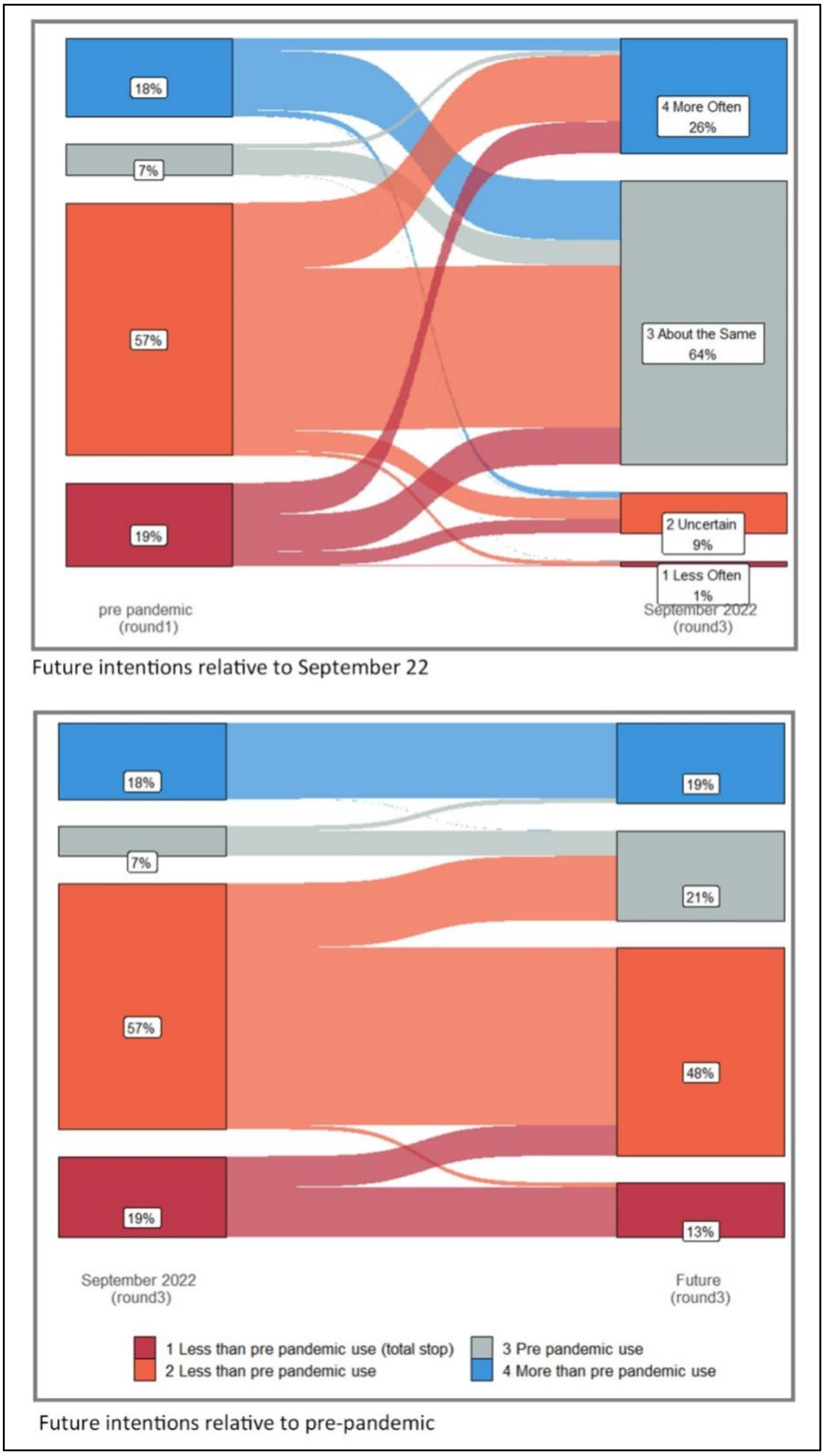

Figure 6. Top) September 2022 transit use (relative to pre-pandemic) and intended future transit use (relative to September 2022). Bottom) intended future transit use (relative to pre-pandemic) when the pandemic is over.

Figure 6 also shows the intended future transit use relative to their pre-pandemic transit use instead of relative to current (September 2022) use. We did not directly ask respondents to compare their intended transit use in the future to their pre-pandemic transit use because we did not expect accurate recall about pre-pandemic transit use. In this figure, we inferred respondents' intention relative to pre-pandemic transit use based on the question about whether their transit use will increase or decrease relative to their current (September 2022) transit use shown in Figure 6. This plot indicates that most transit riders have not fully returned to pre-pandemic levels and most expect to maintain their current (September 2022) level of transit use. Approximately half of the transit users will remain below their pre-pandemic transit use and over 10% will not return at all.

5. DISCUSSION AND CONCLUSIONS

We investigate the persistence of transit ridership reductions in two Canadian cities in the wake of the Covid-19 pandemic. Using data from multiple waves of the Public Transit and Covid-19 Survey in Canada, we find that while some individuals have gradually returned to their pre-pandemic levels, over half of transit riders have not fully resumed their pre-pandemic transit usage, and nearly a fifth have not returned at all. Key demographics related to higher transit usage relative to before the pandemic include living in Vancouver (versus Toronto), car ownership, gaining a job, and being a person of color. Factors such as easy access to transit stops, frequency of vehicles and trips, and proximity of home and job locations to transit stops were all cited as important factors in the decision to use transit.

For future transit use intentions when the pandemic has ended, Most transit riders perceive that the pandemic is over but its effects are here to stay. Also, respondents are split about whether the pandemic still affects their transit use. While some individuals have gradually returned to pre-pandemic transit levels, about half of transit riders will return to transit at a lower level of usage than they had before the pandemic, while about 10% do not intend to return at all.

Overall our results indicate that in the "new normal", transit use will continue to remain below pre-pandemic levels for those who rode transit before the pandemic. The findings of this study indicate that enhancing accessibility, improving service quality, and addressing concerns related to safety and cleanliness are important for maintaining public confidence in transit systems. Owning a car or gaining more access to driving options such as car sharing significantly is related to not returning to transit, although this may reflect a choice to leave transit rather than cause a mode shift.

This study contributes to the understanding of transit ridership dynamics during the Covid-19 pandemic and offers insights into the factors influencing peoples' decisions regarding their transit use in the future. The findings highlight the importance of accessibility, convenience, and individual preferences in shaping transit choices. By considering these factors and understanding the complexities of the "new normal" for transit use, policymakers and transit agencies can develop strategies and interventions that promote transit recovery.

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AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: P. Pezeshknejad, D. Rowangould, data collection: P. Pezeshknejad, D. Rowangould, M. Palm, analysis and interpretation of results: P. Pezeshknejad, D. Rowangould, M. Palm, and draft manuscript preparation: P. Pezeshknejad,

D. Rowangould, M. Palm. All authors reviewed the results and approved the final version of the manuscript.

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