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Canadian transit agencies response to COVID-19: Understanding strategies, information accessibility and the use of social media

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ABSTRACT

Over the past few months, transit agencies across Canada have been rushed to implement a range of strategies in response to the COVID-19 pandemic, with no standardized guidelines to direct their efforts. This study explores the initial response of transit agencies serving the 25 most populous Canadian cities by understanding the distinct types of response measures implemented between March 1st and June 1st, 2020. It also explores to what extent information related to these measures was accessible and usable, and how transit agencies used social media to communicate their efforts to the public. To achieve these goals, a detailed review of Canadian transit agencies websites and social media accounts was performed. The findings suggest that larger transit agencies across Canada implemented the most measures to respond to COVID-19, but not necessarily provided the most accessible information regarding the measures. Overall, while all transit agencies reduced the offered service frequency and capacity and enhanced vehicle cleaning, the implementation of other physical and communication measures varied considerably between agencies. Information related to the number of COVID-19 cases within the workforce was least accessible across agencies. Transit agencies’ Twitter platforms were used more by larger agencies. While most of transit agencies tend to employ tweets that include some type of graphics, very few agencies employed videos and animations to communicate important information to the public. This paper provides transit planners and policymakers with comprehensive information regarding the initial response of Canadian transit agencies to maintain operations in such critical times.

1. Introduction

The COVID-19 pandemic is believed to have originated in Wuhan, China in December of 2019. As the virus rapidly spread across countries, the World Health Organization declared the outbreak a pandemic in March of 2020 (World Health Organization, 2020). As recommended by health authorities, the closure of schools, non-essential services and gatherings was common in many countries. Lockdowns and quarantines were implemented to slow the spread of the virus in many urban areas. These measures can be referred to as physical distancing measures, which are strategies used to minimize proximity and close contact within communities. This includes avoiding crowded places, maintaining two-meter separations, and limiting crowd sizes in high risk spaces (Government of Canada, 2020a). These public health measures, which have been employed globally, have had immense impacts on mobility patterns, as most out-of-home activities are cancelled or reduced.

Due to physical distancing, travel demand largely decreased, as residents were required to stay home and travel only for necessity (De Vos, 2020). Accordingly, a significant decline in transit ridership was observed across Canadian cities. At the same time, transit agencies reduced their services to minimize costs. This was necessary to address the lack of mobility needs due to cancelation of many out-of-home activities (Jeffords, 2020). In fact, public transportation systems can be considered high-risk environments for the spread of COVID-19. This is due to the high numbers of people confined in limited space and the risk associated with commonly touched surfaces (UITP, 2020). However, certain factors related to public transit travel, like travel time and seating position in proximity to the infected traveller, can significantly affect infection risk levels. Although overall risk levels associated with transport have been deemed high, public transport continues to be an essential service for many users, particularly for low-income essential service workers. Therefore, understanding how transit agencies are responding to this pandemic and communicating their efforts is essential.
Good physical and communication strategies can decrease the spread of the virus and shape people’s overall perception of public transit safety. This study explores transit agencies’ initial response to the COVID-19 pandemic by understanding the types of physical and communication measures that have been implemented by transit agencies across Canada. More specifically, it understands the distinct types of response measures implemented by transit agencies serving the 25 most populous Canadian cities between March 1st and June 1st, 2020. Then, it explores to what extent information related to these measures was accessible and usable, and how transit agencies used social media to communicate their efforts to the public. Exploring these issues provide transit planners and policymakers with comprehensive information regarding the initial response of Canadian transit agencies to maintain operations in such critical times, helping them in developing more effective strategies to deal with such future challenges.

2. Literature review

A considerable number of studies have recently been developed focusing on the demand side (i.e., users) response to the pandemic in terms of changes in travel behaviour and perceptions (Beck and Hensher, 2020; Bucsky, 2020; De Vos, 2020; Kim, 2021). For example, Beck and Hensher (2020) indicated that users are now extremely concerned about the level of hygiene on public transportation in comparison with prior to COVID-19 period, demonstrating a likely high aversion to public transport. Hotle et al. (2020) used a large social survey to investigate risk perception and risk mitigation travel-related decisions. They indicated that several factors including trip purpose, gender (male vs. female), and experience with influenza-like symptoms have significant impacts on risk perceptions and travel behaviour. Using large-scale crowdsourced data and natural language processing techniques, Mojumder et al. (2021) explored users’ risk perception and challenges associated with ridesharing. Major concerns were related to personal hygiene, staying at home, personal protective equipment use, and concern of disease spread due to ridesharing.

Other researchers focused on exploring the impacts of the pandemic on travel mode choice, travel distance, and public transit use (Abdullah et al., 2020; Rauws and van Lieper, 2020). These studies generally indicated a shift from using public transport modes to the use of private automobiles and active transportation modes such as biking and walking. In this line of research, Jenelius and Ceceubauer (2020) investigated the impacts of COVID-19 on daily public transport ridership in the three most populated regions of Sweden, indicating huge declines in ridership, which varied by the region. They also found that a large number of riders switched from 30-day period tickets to single tickets. Liu et al. (2020) utilized hourly transit demand data collected from Transit App, a popular mobile application that provides real time transit data and trip planning, to understand changes in transit demand in the United States. Using this dataset, they indicated that communities with higher ratios of socially disadvantaged populations tend to retain higher levels of minimal demand during COVID-19. Similar results were suggested by Caicedo et al. (2021) using smartcard data collected from Bogota’s BRT system.

In contrast to previous efforts, less attention has been given to the overall response of the supply side (i.e., transit agencies). Only one effort by McGowan (2021) used a document analysis approach and short interviews to document and understand Grand River Transit (GRT) in the Region of Waterloo response to COVID-19. Indeed, transit agency responses to COVID-19 play an important role in shaping users’ perception of the offered quality of service by addressing COVID-19 related issues (such as level of hygiene). Another important issue is how transit agencies communicated their efforts and utilized social media to deliver critical information to transit users. During the COVID-19 pandemic, social media played a key role in relaying information, and rapidly became a “ubiquitous part of modern healthcare systems” (Wong et al., 2021). Indeed, social media platforms have provided new opportunities for businesses, agencies, and consumers to engage in social interaction over the internet (Haji, 2014). Furthermore, the effects of fast-growing social media are twofold for public relations professionals aiming to develop favorable relations between their organizations and stakeholders (Uzunoglu et al., 2017). This is important in the context of COVID-19, as researchers have found that when consumers have easy access to information through social media, they become more responsive to ethical issues (Balleg et al., 2015).

Several researchers used social media data, particularly Twitter data, to evaluate users’ perception of the transit service quality, and the impacts of service interruptions and the COVID-19 pandemic on users’ perception (El-Diraby et al., 2019; Haghigihi et al., 2018; Hosseini et al., 2018; Monmousseau et al., 2020). For example, Hosseini et al. (2018) developed a methodology for utilizing Twitter data to understand the impacts of transit service disruptions on transit users’ satisfaction. Monmousseau et al. (2020) used Twitter data from airlines and passengers to assess the impacts of travel restriction measures imposed during the COVID-19 pandemic on passengers’ perception. Nevertheless, none of the previous efforts explored how public transit agencies used their social media accounts during the pandemic. To address the abovementioned gaps in the literature, this research understands the distinct types of response measures used by transit agencies and explores how transit agencies used their websites and social media accounts to communicate information related to these measures.

3. Study context

To understand the reactions and responses of transit agencies to the COVID-19 pandemic, the 25 most populous cities in Canada, and their corresponding transit agencies were analyzed. The 25 transit agencies vary in the types of services they provide, this is especially significant in comparing the top three agencies to the other agencies. The Toronto Transit Commission (TTC), Vancouver Translink, and The Société de transport de Montréal (STM) are the only multimodal transport systems among the 25 agencies selected for study, with Montreal and Toronto being the only agencies with a subway system. Light rail is present in other cities, including Edmonton and Calgary, as well as Vancouver’s Skytrain system. Vancouver also incorporates ferry systems into the Translink system, providing an integrated land and water transport system.

Further, the selected cities are all in the top 25 for ridership levels in 2016, except for Kelowna and Oakville, which are at 27 and 33, respectively. Table 1 shows the list of cities and transit agencies incorporated in the study, with 2016 population and ridership statistics. Throughout the paper, the city name and the agency name will be used interchangeably to fit the required context. It is important to note that different provinces experienced the pandemic differently, in terms of the number of cases, when first cases were confirmed, and in turn, the severity of restrictions. For example, some cities, like Halifax, did not have their first confirmed COVID-19 case until mid-March, while others, like Toronto, had confirmed cases by the end of January, approximately 2 Months prior to Halifax. This is indicated by the fifth and sixth columns of Table 1.

The hardest hit provinces were Alberta, British Columbia, Ontario and Quebec, with these provinces having the most deaths due to COVID-19 by June 1st, 2020 (Government of Canada, 2020b). It is important to note that Canada experienced the first stages of the pandemic at a later period than many other countries, which allowed for more preparation and planning. Within Canada, mid to late March is when the physical distancing measures started to take effect across provinces, with no clear guidelines for transit agencies in Canada (CUTA, 2020). In fact, the first guidelines were published after finishing the paper analysis by the end of June 2020 (CUTA, 2020). Physical distancing measures continued to be in place through the study period, and will continue to be in place for Canadian cities for the unforeseen future.
Transportation Research Interdisciplinary Perspectives 12 (2021) 100465

4. Methods

4.1. Response measures

To assess the variety of strategies that were implemented to respond to the pandemic, a detailed review of agency websites was performed. The systematic review was conducted in early June and considered changes implemented from March 1st to June 1st. Transit agency websites were reviewed to understand the range of physical and communication strategies and approaches that were utilized to respond to the COVID-19 pandemic in addition to information accessibility and usability issues.

The purpose of the review was to identify and synthesize measures and strategies used to create a comprehensive set of factors that all agencies could be assessed by. A thorough review of the different related sections and pages on transit agencies websites was conducted to find published information on the COVID-19 pandemic. Additionally, to make sure that the review process is capturing all the data, a keyword search using “COVID-19” and “COVID” was conducted to locate sections and pages published in relation to the pandemic. The review process was also completed with an effort to mimic how a transit user would interact with an agency website to find relevant information needed during the pandemic. This is an important issue to understand to which the purpose of this study, we refer to each province’s approach for re-opening as stages instead of phases. Nova Scotia does not have a clear staged approach, but rather a specific plan for re-opening of different types of economic sectors. Stage 1 often included allowing outdoor gatherings of a small number of people, recreational travel within region, and re-opening come exercise activities (low intensity, no spectators). Stage 2 included the capacity for outdoor gatherings, in some cases allowed for travel within provinces, high intensity indoor sports and physical activity was allowed. Stage 3 and 4 include the continuation of returning to workplaces, looser restrictions on mask use, interprovincial travel, and overall increased social contact. The later stages often are the last stretch towards trying to return to pre-pandemic levels. It is important to note that stages often include similar factors, but with an increase in capacity. For example, Stage 1 may allow outdoor gatherings of up to 15 people, whereas Stage 3 may allow outdoor gatherings of up to 50.

4.2. Information accessibility and usability

The second objective of this website assessment was to check how accessible the information on the implemented measures would be to changes, which include adopting weekend schedules on weekdays, removing and cancelling trips, and adding trips and supplement service. The second category refers to factors related to transit vehicles. This category includes items such as enhancing vehicle cleaning, requiring travelers to use the rear door for boarding/alighting, adding distancing seat signage and barriers to protect operators, and providing vehicle capacity information to users.

The third category refers to factors related to transit facility, which includes enhancing facility cleaning, closing some facilities, and adding sanitizing dispensers and physical distancing markers. The fourth category refers to system wide changes and includes fare changes, recommending and issuing masks for users and operators, and acquiring an additional workforce for cleaning. The fifth category is related to employee health in terms of providing information about the number of cases among employees and these cases locations and roles. The last category is related to other issues such as providing COVID-19 Frequently asked question (FAQ) pages, recommending the use of active transportation modes, and using COVID-19 Feedback forms.

To conduct the assessment, MS Excel was used to organize the data. Each agency site was reviewed for each factor. Due to the rapidly evolving nature of the situation caused by the pandemic, changes were being issued daily and weekly, offering a unique challenge for data collection. In attempts to keep track of the large amounts of information being gathered, PDF copies of relevant pages from websites were saved. The records were reviewed for the second time after creating the initial excel sheet to ensure the accuracy of the information. Fig. 1 shows the research process.

Table 1

| City            | Transit Agency Name               | Population (2016) | Ridership (2016)* | First Confirmed COVID-19 case (by province) | Stage of Opening |
|-----------------|-----------------------------------|-------------------|-------------------|--------------------------------------------|-----------------|
| Toronto, ON     | Toronto Transit Commission-TTC    | 2,731,571         | 538.08            | Jan 31st, 2020                             | Stage 1         |
| Vancouver, BC   | Translink                         | 2,439,841         | 232.98            | Jan 31st, 2020                             | Phase 2         |
| Montreal, QC    | Société de transport de Montréal-STM | 1,942,039       | 416.18            | Mar 1st, 2020                              | Phase 4         |
| Calgary, AB     | Calgary Transit                  | 1,239,220         | 102.50            | Mar 8th, 2020                              | Stage 1         |
| York Region, ON | York Region Transit-YRT          | 1,109,909         | 22.41             | Jan 31st, 2020                             | Stage 1         |
| Ottawa, ON      | OC-Transpo                       | 934,243           | 96.47             | Jan 31st, 2020                             | Stage 1         |
| Edmonton, AB    | Edmonton Transit                 | 932,546           | 87.17             | Mar 8th, 2020                              | Stage 1         |
| Mississauga, ON | MiWay                             | 721,599           | 38.60             | Jan 31st, 2020                             | Stage 1         |
| Winnipeg, MB    | Winnipeg Transit                 | 705,244           | 48.52             | Mar 12th, 2020                            | Stage 1         |
| Durham, ON      | Durham Region Transit-DRT        | 645,862           | 10.19             | Jan 31st, 2020                             | Stage 1         |
| Brampton, ON    | Brampton Transit                 | 593,638           | 23.13             | Jan 31st, 2020                             | Stage 1         |
| Quebec, QC      | Réseau de transport de la Capitale-RTC | 577,304         | 44.91             | Mar 1st, 2020                              | Stage 4         |
| Hamilton, ON    | Hamilton Street Railway-HSR      | 536,917           | 21.50             | Jan 31st, 2020                             | Stage 1         |
| Waterloo, ON    | Grand River Transit-GRT          | 468,128           | 10.31             | Jan 31st, 2020                             | Stage 1         |
| Laval, QC       | Société de transport de Laval-STL | 622,993           | 22.01             | Mar 1st, 2020                              | Stage 4         |
| Longueuil, QC   | Le Réseau de transport de Longueuil-RTL | 415,347       | 33.40             | Mar 1st, 2020                              | Stage 4         |
| Halifax, NS     | Halifax Transit                  | 403,162           | 18.99             | Mar 16th, 2020                            | N/A             |
| London, ON      | London Transit                   | 383,822           | 22.57             | Jan 31st, 2020                             | Stage 1         |
| Victoria, BC    | BC Transit: Victoria             | 347,426           | 25.50             | Jan 31st, 2020                             | Stage 2         |
| Gatineau, QC    | Société de transport de l’Outaouais-STO | 276,245         | 19.23             | Mar 1st, 2020                              | Stage 4         |
| Windsor, ON     | Windsor Transit                  | 247,368           | 6.51              | Jan 31st, 2020                             | Stage 3         |
| Saskatoon, SK   | Saskatoon Transit                | 246,176           | 12.30             | Mar 12th, 2020                            | Stage 1         |
| Regina, SK      | Regina Transit                   | 215,106           | 5.21              | Mar 12th, 2021                            | Stage 1         |
| Oakville, ON    | Oakville Transit                 | 193,852           | 2.85              | Jan 31st, 2020                             | Stage 1         |
| Kelowna, BC     | BC Transit: Kelowna               | 189,077           | 4.93              | Jan 31st, 2020                             | Stage 2         |

* In terms of annual linked trips in millions.

** On June 1st 2020. It should be noted that some provinces refer to their stages of re-opening as phases, but both terms refer to the same idea. Therefore, for the purpose of this study, we refer to each province’s approach for re-opening as stages instead of phases. Nova Scotia does not have a clear staged approach, but rather a specific plan for re-opening of different types of economic sectors. Stage 1 often included allowing outdoor gatherings of a small number of people, recreational travel within region, and re-opening come exercise activities (low intensity, no spectators). Stage 2 increased the capacity for outdoor gatherings, in some cases allowed for travel within provinces, high intensity indoor sports and physical activity was allowed. Stage 3 and 4 include the continuation of returning to workplaces, looser restrictions on mask use, interprovincial travel, and overall increased social contact. The later stages often are the last stretch towards trying to return to pre-pandemic levels. It is important to note that stages often include similar factors, but with an increase in capacity. For example, Stage 1 may allow outdoor gatherings of up to 15 people, whereas Stage 3 may allow outdoor gatherings of up to 50.

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transit users, while looking at information usability. Previous research has been conducted in relation to transit passenger information websites, including a 2009 publication by Currie and Gook (2009). In the context of this research, website accessibility was measured by counting the number of clicks it took to arrive at necessary information. The number of clicks began after navigating off the homepage of the transit agency site. Furthermore, to aid in comparing the ease of access across sites, a scale was created to categorize the agency sites by access level. The scale started with high access level being zero to one click, medium access levels being two to three clicks, and low access level being 4 clicks or more. Moreover, after measuring the access level to the distinct information, an average access level was calculated based on the available information collected for each site.

For this section, a smaller number of factors were considered as data related to the same category (discussed above) can be located on the same page. For example, employee health factors were found to be on the same page, similarly fare changes factors. The final set of included factors were of high importance due to their impact on public transit usage and perceptions of safety. A few new factors were incorporated to represent service changes information type. Service information plays a vital role in public transportation use and access. The COVID-19 pandemic increased user’s uncertainty regarding service delivery, resulting in route suspensions and reductions, and scheduling changes. Other sets of factors included vehicle safety, and facility and system factors. On board safety and facility cleaning procedures and protocols are critical to be communicated quickly and efficiently to the public. These factors emphasize the idea of transit use during COVID-19 being comfortable and safe.

For this study, information usability is related to providing information in different formats and languages to be useful for a variety of users. The assessment of information usability included the presence of a journey planner on the website. The inclusion of route map and timetable PDFs updated to suit COVID-19 service levels, and multilingual resources on COVID-19 were also considered. Additionally, translated COVID-19 resources in PDF format and translate page option available on some websites were checked for.

4.3. Communication of information through social media

Many transit agencies are not limited to their websites to communicate valuable information. The use of social media platforms has played an important role in agency-user communication throughout the pandemic. Therefore, data from Twitter, a popular social media platform was analyzed for the purpose of this study. Other platforms, such as Facebook, were also explored. However, they were noticed to be less popular among transit agencies, with a few transit agencies even choosing to not have a dedicated transit Facebook page. This is the reason why Twitter was chosen as the sole social media platform to assess communication of information from transit agencies. The only agency which did not have a presence on Twitter was Transit Windsor, and thereby, the agency was removed from this section.

The data collected for this study ranges from tweets posted between March 1st to June 1st. In order to review the types of information being released by agencies on Twitter, a keyword search was conducted, with a focus on COVID-19. This keyword search included hashtags and the usage of certain words in tweets. Only tweets published by transit agencies to the public were accounted for, while replies were dismissed. This was done to provide an overview of how many COVID related tweets were shared by transit agencies. It was noticed that the Twitter page of Kelowna and Victoria is shared under one account. Therefore, they were both counted together under one name (BCtransit). Vancouver and Longueuil were observed to have multiple Twitter accounts dedicated to transit. In the case of Vancouver, the page with the most followers was considered. On the other hand, the most followed transit Twitter page for the city of Longueuil was (@RTL_info), which mostly provides information on route changes, and little on general announcements. Thus, the agency’s second most followed transit page (@RTL_Longueuil), which provided significantly more COVID-19 related information was considered instead.

An initial review of the tweets was performed to understand the range of words that were used by the different agencies regarding COVID19. While doing this, different keywords were tested, which were based on the results of the previous website analysis. This resulted in the list of relevant keywords which the agencies were being assessed for. According to the initial review, keywords related to the pandemic were broken down into 5 categories, these being COVID19, Essential, Masks, Social Distancing, and Home. It was important to include all the common variations of the keywords to ensure accurate representation of each term when assessing for tweets by agencies. The ‘COVID-19’ keyword search consisted of six variations of the term, including COVID, COVID19, COVID-19, coronavirus, covid19ab, and covidab. The last two keywords were applied as they were often used in tweets by Calgary and
Edmonton, the “ab” representing the provincial acronym of Alberta. The ‘Essential’ keyword search consisted of four variations, these being essential, frontline, essential, and essentielle. The latter two keywords were implemented to accommodate for tweets by French transit agencies. The ‘Essential’ category refers to essential workers, travel, and destinations. The ‘Masks’ keyword search consisted of the seven variations, including mask, masks, face covering, facecovering, masque, visage, and couverture. The ‘Distancing’ category consists of five variations including distance, distancing, physical distancing, social distancing, and socially. Lastly, the ‘Home’ category consisted of home, stayhome, and maison. These tweets refer to agencies and their efforts in promoting physical distancing by supporting the reduction of out-of-home activities.

After identifying the relevant tweets, to explore the context and content in which the keywords were being used in tweets, the tweets were assessed on a series of subcategories. These included Web, Mentions, Graphics, and Videos. The ‘Web’ category indicates tweets provided a link to a relevant website for the consumers (transit users) to go for more information. Sharing informative links is important as it can get followers interested in the story with their tweets in the same way newspapers use headlines (Lovejoy, Waters, & Saxton, 2012). For example, on April 6th, Winnipeg Transit posted the following tweet: “…. … For more information on safe social distancing on Winnipeg Transit, visit: http://ow.ly/NvVq50z6WVL.” That post exemplifies the use of links that the web category explored. The ‘mentions’ category indicates if a public authority was mentioned in the tweet. An example of this is Toronto’s Twitter transit page, which tweeted on April 14th, “Help prevent the spread of #COVID19. Please follow the advice of @TOPublicHealth…”

It is important to note that throughout the data collection if a single tweet contained two mentions, it was counted as one. The ‘Graphics’ category is related to the use of images or GIFs in a post alongside a tweet. The purpose of this category was to portray the quality of the tweet and the effort a transit agency is putting into providing visual information to the public. The ‘Videos’ category is similar, indicating the use of a video or animation within a tweet. These last two visual categories are important as they would provide higher accessibility to individuals with varying levels of literacy or official language fluency.

5. Results

5.1. Implemented measures

The findings of the website review analysis revealed a set of 28 physical and communication measures, and the 25 agencies were all assessed for each measure. It is important to note that these results are only based on the website review. Some agencies may in fact have implemented certain measures, but not communicated them on their websites. Table 2 shows the categories and the measures that fall within each category. These categories will be further explored and analyzed further in the paper. The table also depicts both the number and percentage of agencies that implemented the respective measure. From the table, it can be observed that while all transit agencies reduced the offered service and enhanced facility cleaning, the implementation of other measures varied between them.

Of the service change measures, all agencies reported a reduction of service, with Windsor completely stopping transit service for a period of time in late March and early April (Cross, 2020). While all 25 agencies reported a service reduction, the types of reductions varied per agency. The adoption of weekend schedules (i.e., Saturday schedules) on weekdays was an approach identified in seven agencies (28%). In contrast, six agencies (24%) adopted “enhanced” Saturday schedules on weekdays, while only one agency (4%) adopted enhanced Sunday schedules. Summer service levels were also adopted by two agencies (8%).

Transit operators often report having good experiences with adopting weekend timetables due to the familiarity that transit users would have with these types of service hours. Given pre-existing information on weekend service hours, the service changes cause minimal confusion and fewer complications for transit users (UITP, 2020). The other agencies used other predetermined schedules, and all agencies monitored for overcrowding on buses and adjusted services accordingly. However, only six agencies (24%) provided users with clear and precise information regarding vehicle capacity (or load). For example, Saskatoon Transit mentioned that bus loads of all routes are reduced to half, and as long as a 2 m distance can be maintained, more than 10 passengers will be permitted to ride.

Of the 25 agencies, only one was found to have implemented supplemental services for healthcare workers. This was Edmonton Transit, which introduced a late night supplemental service. The service “one-way trips between 10:00 pm and 1:00 am,” with the agency stating that essential healthcare workers may be eligible and should register for the service if required. In reviewing the rest of the agency sites, there was no indication that other agencies were specifically attributing special services for eligible healthcare workers or offering a complementary demand-responsive service to the transit service.

All transit agencies enhanced vehicle cleaning by improving its frequency and implementing new cleaning procedures that focus on sanitizing frequently touched surfaces.

Rear door boarding/exiting was also implemented by 24 agencies all agencies at points throughout the pandemic, with Winnipeg being the agency opting not to implement rear-door boarding. The purpose of rear
door use was to protect operators from coming into close proximity with users. The protection of agency employees was a leading factor in the implementation of separated transit operator areas. Protected operator areas were found to have been implemented by 22 agencies (88%) and were introduced at distinct time periods at each agency. Though the method was common, the 22 agencies implemented the measure to different degrees. For example, 15 agencies indicated that a protective shield was planned or already installed to protect operators on transit. Conversely, seven agencies reported using less restricted operator-user distancing measures such as roping off or marking off the front section of vehicles for operator use only. These measures are important because they assure transit users that there is an effort being made in protecting the employees they interact with. In total, 14 agencies (56%) used distancing seat signage on-board the vehicles to restrict users’ access to selected seats in an effort to ensure physical distancing. Regarding facility changes, it was common to see transit agencies citing enhanced facility cleaning strategies (22 agencies, 88%). Other used measures include providing additional sanitizing dispensers in facilities (6 agencies, 24%) and closing service centres and indoor passengers’ areas (16 agencies, 64%), while only five agencies (20%) implemented physical distancing markers at facilities.

As a result of rear door boarding and operator protection measures, the collection of fares was also impacted by the pandemic, with a large majority of agencies (24 agencies, 96%), discontinuing the collection and validation of fares at some point throughout the pandemic. This was often due to physical configuration of vehicles, with no validation or collection boxes located near the back or middle doors of vehicles. Though validation and collection was not being enforced, in many cases agencies would rely on the honour system, hoping that users would pay before boarding. This shows a considerable revenue loss for transit agencies. Nevertheless, if an agency clearly demonstrates that it is protecting employees, this suggests that user protection is also of important priority on the transportation system, assuring trust and security during pandemic transit ridership. None of the transit agencies required users to use masks during our study period, however, most of the transit agencies recommended passengers to use masks (24 agencies, 96%), while 11 (44%) and 10 (40%) issued masks and sanitizers for transit operators, respectively. In contrast, only five agencies (20%) were found to have complimentary masks for users available at points throughout the pandemic, and these were often handed out at specific times and places on or near the transport system. Indeed, using appropriate masks could prevent the spread of the virus.

Another measure that would assure trust and security is the release of information regarding employee health during the pandemic. The release of information regarding COVID-19 infections among agency staff, whether it be operators, maintenance, cleaning, or service staff is highly important. This information would provide users with knowledge of COVID-19 infections and allow them to assess the risk of using the transport system. Six agencies (24%) were found to have posted positive COVID-19 status amongst agency employees. Of the six agencies, some websites had a dedicated webpage section to employee health, while others used press releases to advise the public of risks. Of the six, all of them provided the role of the employee, five provided the places of work the employee frequented, and one provided a status update for the infected employee. The more of these details provided, the higher the level of trust and perception of safety that the agency and system would have from both the public and from users. It is important to note that some agencies may not have had COVID-19 cases amongst staff, however, the communication of the lack of cases is deemed to be as important as communicating positive cases amongst staff.

Another important factor throughout the pandemic is agency communication with the public. In its set of guidelines for public transport operators, the UITP (International Union of Public Transport) identified communication as an important aspect for transit agencies during the pandemic (UITP, 2020). One of the ways they considered communication was through a Questions and Answers section, which was considered in respect to providing the employee with information. In this study, we considered communication in terms of a COVID-19 frequently asked questions (FAQ) and COVID-19 feedback options, while the following section considers communication by using social media.

The FAQ section is important on all transit sites, but during the pandemic, the FAQ can provide reassurance and comfort during the uncertainty of service changes. Only eight of the twenty agencies (32%) were found to have provided a COVID-19 FAQ. The FAQ sections varied in the amount of information that they provided, with the eight agencies all having differing levels of information available. The TTC (Toronto) included 33 questions, which was the highest amount, and the lowest was the STM (Montreal), with 5 questions. The average number of questions provided in FAQ’s on agency websites was 15 questions. Another aspect that was searched for in communication between agencies and users was COVID-19 feedback options. This was even less common than the FAQ section, with only one agency having a COVID-19 form of feedback available. These feedback options were contextualized to COVID-19 and allowed users to give feedback or voice concerns regarding changes implemented due to the pandemic. Calgary Transit was the only agency that was found to have a COVID-19 tailored feedback option. Only two transit agencies directed transit users to use active transportation modes as opposed to vehicular transport in response to COVID-19.

Fig. 2 shows the number of implemented strategies by transit agencies. The transit agencies in the figure are organized in descending order. The figure also shows the type of categories implemented by transit agencies using different colours. This is to illustrate the mix of the used measures. It should be noted that not all measures are equal in importance to users and agencies. Nevertheless, the total number of measures highlights both the transit agency overall response and their efforts in communicating these measures to the public. Most of the measures are mainly targeting transit users, helping them in staying safe while using the transit service. For example, service, vehicle, and facility changes have a direct impact on users and their perception of the safety of the service. The employee health category is also related to transit users’ perceptions. Some system changes such as issuing sanitizers for operators and recruiting an additional workforce for cleaning can be more related to transit agency operations and not directly affecting users.

As seen in Fig. 2, all transit agencies used diverse types of measures from different categories, with a minimum of using measures related to service changes, vehicle changes and system changes. The transit agency which implemented the most measures to respond to the COVID-19 pandemic was STM (Montreal), adopting 19 of 28 measures. The STM implemented measures were balanced across all categories. The next transit agencies which presented the most changes were the Toronto Transit Commission and the Réseau de transport de Longueuil (RTL), each with 17 of 28 changes implemented. Lastly, Winnipeg Transit and Regina Transit were found to have implemented the least measures, with only 6 and 5 measures implemented, respectively.

The agencies implementing the most changes are also agencies that demonstrate high levels of ridership, while the agencies which implemented the least measures often have less ridership and lower budgets. Since some cities have very low ridership in Canada, the decrease in service caused by the COVID-19 pandemic put them in a critical position related to financial viability. The worst-case scenario for this was the City of Windsor, in which transit operations shut down due to the COVID-19 pandemic and due to the fact that keeping the system for such low ridership would be a large financial loss for the city. Mississauga, despite being in the top 10 for population and ridership, did not implement many measures. Across the 25 agencies, the average number of measures implemented was 12.
5.2. Information accessibility and usability

Another aspect of the website review was to understand which agency provided the most accessible information. Table 3 shows access level by agency for various factors. The light green colour represents highly accessible information, yellow depicts medium access, whereas light red indicates low access. In addition to this, the gray indicates that the factors being searched for were not found, suggesting the high difficulty of access or complete lack of implementation of the respective measure. Table 3 should be read in conjunction with Fig. 2. For example, the STM in Montreal, which implemented the most strategies (Fig. 2), had a good average information accessibility compared to other agencies, with a score of 1.2 for general information accessibility (Table 3). It should be noted that the score uses the actual number of clicks and some information required zero clicks to reach. The agencies with the least accessible information level were Winnipeg Transit, Oakville Transit, and Hamilton Transit. However, Hamilton Transit has a reasonable number of measures compared to other agencies (Fig. 2). Accessibility is important because a higher access level suggests an easier experience for users which requires essential information. Translink (Vancouver) is ranked high on both the accessibility and the number of measures scales. It is also important to note that although some agencies provided little information, like Regina Transit, they still rank high on the accessibility scale due to the access to the information they did provide. The most accessible measures were vehicle safety factors and facility cleaning, often being found one click away from the home page or less. Information regarding employee health was deemed to be the most difficult to find, often taking a few clicks or not being found at all.

As seen in Table 3, access to information varies across the 25 agencies. In complementing the accessibility of information, the usability of information by providing information in different formats that might be useful to a variety of users was also considered. This assessment included the presence of a journey planner, the inclusion of updated route map and timetable PDFs, translated page options and foreign language COVID-19 resources in PDF format. The results from the 25 agencies on these five factors are depicted below in Fig. 3. It is important to note that many agencies have never provided a translate page option or any translated materials before COVID-19. But, as Canada has two official languages (English and French), in addition to a considerable number of recent immigrants and refugees, who tend to have low income jobs (Crossman, 2013), it was explored. Only one transit agency,
namely Translink, was observed to have PDF resources on COVID-19 in four different languages that are not English or French.

The journey planner was the most common factor. Journey planners offer the needed information to users with a great ease (Currie and Gook, 2009). In fact, in many cases, transit agencies would not offer timetable PDF due to the uncertainty of service level requirements due to COVID-19 and focused on directing users to employ journey planners. Therefore, only 14 agencies (56%) provided an updated route maps PDFs, while only 12 agencies (48%) were found to have provided users with an updated PDFs of route timetables that are accessible. Indeed, PDF files provide a method for users who prefer to print them to have a hard copy of timetables. It is important to note that some agencies may have not

### Table 3

| City       | Service Information | Vehicle Safety | Facility changes | System changes | Other factors |
|------------|---------------------|----------------|-----------------|----------------|---------------|
| York       |                     |                |                 |                |               |
| Regina     |                     |                |                 |                |               |
| Durham     |                     |                |                 |                |               |
| Kelowna    |                     |                |                 |                |               |
| Victoria   |                     |                |                 |                |               |
| Vancouver  |                     |                |                 |                |               |
| Gatineau   |                     |                |                 |                |               |
| Mississauga|                     |                |                 |                |               |
| London     |                     |                |                 |                |               |
| Windsor    |                     |                |                 |                |               |
| Toronto    |                     |                |                 |                |               |
| Longueil   |                     |                |                 |                |               |
| Quebec     |                     |                |                 |                |               |
| Laval      |                     |                |                 |                |               |
| Montreal   |                     |                |                 |                |               |
| Brampton   |                     |                |                 |                |               |
| Halifax    |                     |                |                 |                |               |
| Calgary    |                     |                |                 |                |               |
| Edmonton   |                     |                |                 |                |               |
| Waterloo   |                     |                |                 |                |               |
| Ottawa     |                     |                |                 |                |               |
| Saskatoon  |                     |                |                 |                |               |
| Winnipeg   |                     |                |                 |                |               |
| Oakville   |                     |                |                 |                |               |
| Hamilton   |                     |                |                 |                |               |
| Average    |                     |                |                 |                |               |

Notes: Access levels across agency sites are depicted by colors. The green indicates high access information, with this being 0–1 click away from the homepage. The yellow is medium access information, 2–3 clicks away from the homepage. Red is low access and is 4+ clicks away from the homepage. Grey is used to indicate that the information being searched for was not found on the website, indicating a lack of measure implementation or a very low accessibility information. The average access is the average number of clicks used to find information across the agency, thus a lower value indicates higher accessibility levels. Grey boxes were not taken into consideration when calculating the average access values.

![Fig. 3. Information usability.](image-url)
provided updated timetable or map PDFs due to service changes to pre-existing schedules. For example, agencies switching weekday service to a weekend schedule would not need to provide updated PDFs, as there are already weekend service PDFs available on their websites. Fewer transit agencies provided translate page functions (eight agencies, 32%) or foreign language COVID-19 resources in PDF format (one agency, 4%) to serve a larger audience of users during the pandemic.

5.3. Social media analysis

The purpose of the social media analysis was to understand the extent to which agencies utilize their social media platforms to convey important messages regarding COVID-19. Table 4 portrays the total number of followers and tweets by a transit agency in addition to each agency’s social media account. As observed in Table 4, Toronto (@TTCnotices), Montreal (@stinfo), and Calgary (@Calgarytransit) are the most popular transit Twitter pages. This is expected since these agencies have the highest ridership in Canada. The fourth column in the table depicts the total number of coronavirus-related tweets posted by transit agencies without accounting for any duplicates caused by multiple keywords in one tweet. Although Hamilton (@hsr) possesses only 6,400 followers, it leads all agencies with the highest number of tweets. Asides from Hamilton, high population cities such as Toronto (@TTCnotices) and Calgary (@calgarytransit) closely follow. Interestingly, the middle-ranged cities are less predictable, with cities such as Saskatoon (@stoontransit) with the 22nd most followers posting the 8th most tweets. Table 4 also portrays the number of COVID-related tweets by agencies per day. In total, there were approximately 15 tweets by all of the agencies per day. Once again, Hamilton is found to be the most active transit agency on social media; @hsr tweeted 3.27 times per day, followed by Calgary and Toronto which tweeted 2.91 and 2.05 times, respectively.

As observed in Table 4, 1401 tweets were released to the public by all transit agencies included in the analysis during the study period. Out of these tweets, 702 tweets included the ’COVID-19’ keywords, 603 included ‘distancing’ keywords, while 258, 189 and 153 tweets included ‘essential’, ‘masks’ and ‘home’ keywords, respectively. Fig. 4 portrays the most used keywords by transit agencies. During the study period, on average, each transit agency tweeted about COVID-19 close to 29 times (SD = 51). Distancing is the second most used keyword behind COVID-19, with an average of 25 tweets (SD = 42). Essential is tweeted on average about 11 times (SD = 10) by transit agency during the 3-month span. ‘Mask’ and ‘Home’ are the least tweeted, averaging about 8 tweets (SD = 14) and 6 tweets (SD = 13). The higher standard deviation of tweets of all the keywords generally shows a considerable variation between transit agencies.

Fig. 5 portrays a breakdown of COVID-19 and distancing keywords usage among agencies. As seen in Fig. 5.A, a difference can be observed between agencies, in which the top four agencies (HSR, Calgary, TTC, STM) tweeted much more than all other transit agencies. Regarding the content of tweets, about 54% of all 702 tweets related to COVID-19 contained links to websites, 15% of tweets mentioned other related accounts, and 87% of all tweets related to COVID contained graphics. Only 8% of all transit agencies employed videos/animations. More specifically, only TransLink and Montreal implemented videos/animations, with a count of 8 and 6 tweets with videos, respectively.

Fig. 5.B illustrates tweets regarding the topic of distancing, Hamilton and Toronto posted 174 and 135 tweets respectively, significantly higher than the rest of the preceding agencies. Of the 603 total tweets by all agencies mentioning social/physical distancing, 31% of all tweets contained links to websites, 8% mentioned public authorities, 47% contained graphics and less than 1 percent incorporated videos/animations. Once again, only Vancouver and Montreal’s Twitter page contained videos/animations, namely with a count of 2 videos.

Fig. 6 portrays a breakdown of essential, masks, and home keywords usage among agencies. Tweets regarding essential services and travel were observed to be more evenly spread out when compared to their previous counterparts, as depicted in Fig. 6.A. There was a total of 258 tweets in relation to the keyword. After breaking down the contents of the tweets, about 25% of tweets contained a link to a website, 2% of tweets mentioned a public authority, 78% implemented graphics and 6% of tweets contained videos/animations. Interestingly, Vancouver was responsible for all of them, with a count of 14.

As portrayed by Fig. 6.B., Calgary and Toronto posted significantly more tweets about using masks than the rest of the observed agencies, outputting 60 and 45 tweets respectively. In stark contrast, the next highest tweeting agency released a total of 14 tweets in relation to the keyword. Of the total 189 mask-related tweets by all agencies, 25% contained links to related websites, 29% referenced public authorities, 96% contained graphics and 1% contained videos. As portrayed by Fig. 6.C., Hamilton led all transit agencies in tweets regarding staying indoors. Of the 153 total tweets, approximately 6% of tweets contained links to a website, one tweet mentioned a public authority, 64% contained graphics to go along with the tweet, and two tweets contained videos and animations.

The previous results show that COVID-related tweets contained significantly more supplementary links to a website than any other keyword. In total, about 54% of all COVID-related tweets contained a link (including duplicate tweets), as opposed to 31%, 25%, 25% and 6% of all ‘distancing’, ‘masks’, ‘essential’, and ‘home’ tweets with a link. This indicates that transit agencies tend to use COVID-related tweets to further inform consumers and the public on the virus by redirecting them to an official website with more information and details.

### Table 4

| Transit Agency               | Twitter Account | # of Followers | Total Tweets | Tweets per day |
|------------------------------|-----------------|----------------|--------------|----------------|
| Toronto Commission           | @TTCnotices     | 405,564        | 189          | 2.05           |
| Société de Transport de Montréal | @stinfo    | 230,640        | 98           | 1.07           |
| Translink BC                 | @TransLink      | 200,216        | 63           | 0.68           |
| Calgary Transit              | @calgarytransit | 123,998        | 268          | 2.91           |
| Halifax Transit              | @HfxTrans       | 57,622         | 22           | 0.24           |
| OC Transpo                   | @OC_Transpo     | 51,267         | 30           | 0.33           |
| BC Transit                   | @BCTrans        | 13,380         | 31           | 0.33           |
| Winnipeg Transit             | @winnipegtransit | 10,454        | 61           | 0.66           |
| Edmonton Transit Service     | @takeetTSalert  | 9975           | 24           | 0.26           |
| Grand River Transit          | @GRT ROW        | 9195           | 20           | 0.22           |
| York Region Transit          | @YRTViva        | 8860           | 26           | 0.28           |
| Brampton Transit             | @BramptonTransit | 6990         | 71           | 0.77           |
| Réseau de transport de la Capitale | @RTCQuebec   | 6720           | 17           | 0.18           |
| Hamilton Street Railway      | @hsr            | 6410           | 301          | 3.27           |
| Durham Region Transit        | @durham_transit | 4864           | 16           | 0.17           |
| MiWay                        | @MiWayHelps     | 4538           | 28           | 0.32           |
| Société de transport de Laval| @ststhynchrho   | 3519           | 7            | 0.08           |
| Société de transport de l’Outaouais | @STOGatineau | 2828           | 1            | 0.01           |
| Réseau de transport de Longueuil | @RTL_Longueuil | 2740          | 8            | 0.09           |
| London Transit               | @LTCLInOnt      | 2237           | 23           | 0.25           |
| Oakville Transit             | @oakvilletransit | 2235         | 38           | 0.41           |
| Saskatoon Transit            | @ststoantransit | 2017           | 42           | 0.46           |
| Regina Transit               | @YQRTransit     | 1637           | 16           | 0.17           |
| Total                        |                 | 1,167,505      | 1401         | 15.2           |
A high percentage of all posts (72%) employed some type of graphic to go along with the tweet. In contrast, the implementation of videos and animations was rarely practiced, as most posts were only by Vancouver and Montreal. Asides from Hamilton, transit agencies with the highest ridership such as Toronto, Montreal, Vancouver and Calgary were noticed to be the most active on social media. This can be attributed to reasons such as greater funding and a larger customer base. Smaller agencies tend to have less funding allocated, thus resulting in a lower online presence.

6. Conclusions

The objective of this paper was to understand the initial response of Canadian transit agencies to the COVID-19 pandemic, which included implementing physical and communication measures. The paper also looked at the levels of information access that were present across agencies and how the transit agencies communicated using social media. To achieve this goal, a detailed review of the websites and social media accounts of the largest 25 transit agencies was performed for the time period between March 1st and June 1st, 2020.

The results show that the largest cities in Canada implemented the most measures. Overall, all transit agencies included in the study reduced the offered service and enhanced vehicle cleaning within their initial response. Other common measures employed by transit agencies included recommending passengers to use masks, enhancing facilities cleaning, implementing rear door boarding/existing, providing...
separated operator areas, adding social distancing seat signage on vehicles, and ceasing to collect fares. In contrast, it was rare to find agencies that provided a supplemental service for healthcare workers, issued masks for users, and shared information about the number of COVID-19 cases amongst the workforce. These measures are important to implement as they have the potential to improve the perceptions of safety that the public holds of public transit during the pandemic.

Transit operations are critical for many individuals, and providing a high level of safety, quality and reassurance during COVID-19 is of the utmost importance for a transit agency.

Another important objective of this study was to understand the levels of information accessibility that were present across agencies. The results showed that the most accessible sites were found to be not necessarily related to the number of implemented measures. The higher level of access the more efficient the agency is at communicating critical and relevant information to transit users. Certain information, like the ones used for the accessibility assessment in relationship to vehicle and facility safety and service changes are essential parts of service

![Fig. 6. Key words usage of A. Essential, B. Masks, and C. Home.](image)
provision, and are even more critical during the uncertainty caused by COVID-19. The least accessible information was related to employee health information if the transit agency is providing such information. Better accessibility to this information can improve users’ trust and perception of the safety of the provided transit service.

The last section of the website review analysis focused on the usability of data for transit users, which looked at the ways information was presented. Overall, most of the transit agencies directed users to employ journey planners, while not offering an updated PDFs of system/route maps or timetables. Very few agencies offered foreign language COVID-19 resources in PDF format to improve the usability of these resources to different segments of society. Therefore, clearer guidelines about providing information in different languages can be developed, particularly for situations such as pandemics, with rapid changes in implemented policies and procedures. Additionally, the type of information conveyed by agencies is important because it further contextualizes the effort of the agency in providing quality service.

The social media analysis revealed some trends in the use of social media platforms for COVID-19 communication. On average, COVID-related tweets contained significantly more supplementary links to a website than any other keyword. Additionally, the majority of tweets employed some type of graphic to go along with the tweet, and only very few agencies using videos and animations to communicate with the public.

Aside from Hamilton, larger transit agencies such as Toronto, Montreal, Vancouver and Calgary were observed to be the most active on social media. This can be attributed to factors such as the availability of resources. Additional funding and social media training can be directed to smaller agencies to have a greater online presence. Future research can explore how users reacted to transit agencies’ tweets, which is not within the scope of this research.

This study presents the first attempt to understand the initial responses of Canadian transit agencies to COVID-19 and depicts best practices amongst Canadian transit agencies. Nevertheless, several limitations and areas for future work exist. For example, future research can explore the development of measures that are used by agencies over time in response to COVID-19. Additionally, this presented research did not look at the impact of service reductions on accessibility to transit service, particularly for low income and essential workers. Therefore, future research can use actual operational data collected from General Transit Feed Specification (GTFS) data to explore accessibility changes amongst urban areas in Canada.

This study provides a detailed review of transit agencies’ websites and social media accounts in Canada to investigate the used measures and issues related to information accessibility and the use of social media. Nevertheless, future research can utilize interviews with transit agencies to understand the decision-making process that took place during COVID-19 and various barriers for implementing different measures, which were not covered in this research. Given the varying sizes of cities, our study did not explore transit agencies’ capacity, available resources, and community engagement processes that were utilized through the implementation of different measures, which can be explored in future research. Indeed, other future research in the field can use the employed methods in the paper to explore other transit agencies’ responses in various regions and countries. Moreover, it is important to consider different social issues related to users’ income, age, gender, and disability. Therefore, future research should incorporate important socioeconomic and demographic data to provide insights into social equity issues in relation to the used COVID-19 response measures, while comparing different transit agencies’ responses.

Regarding the applicability of this research, by understanding the implemented COVID-19 response measures and information communication and accessibility, transit providers can better assess their agencies’ emergency plans, communication strategies, and overall performance. On a similar note, this research can also benefit public health agencies by demonstrating how transit agencies responded and reacted to the recommended health guidelines posed by the health agencies themselves. Moreover, this can have a significant impact on workforce planning, by demonstrating how service changes may have impacted the employment status of transit workers, whether that be operators, customer service representatives, or other positions. Lastly, COVID-19 presented and will continue to present a unique set of challenges for transportation planning and policymaking, but through studying best practices worldwide, transit agencies will be better prepared to deal with and mitigate future impacts caused by pandemics.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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