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Telecommunications networks and public health responses during the COVID-19 pandemic: Evidence from a large national network operator in Canada

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**Telecommunications networks and public health responses during the COVID-19 pandemic:
Evidence from a large national network operator in Canada**

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The views expressed in this paper are those of the authors and do not represent the views of TELUS Communications.

Abstract

The COVID-19 pandemic has demonstrated the fundamental importance of telecommunications networks. This paper utilizes data from a large North American network operator to examine the role of telecom networks in enabling public health and economic responses to the pandemic. During the pandemic, data usage grew significantly, with growth in wireline data use outstripping growth in wireless data use, 53% to 27%, between March and December 2020. Yet, even at pre-pandemic levels, data use is growing exponentially, doubling every 1.3 years between 2017 and 2020. This paper also considers three examples of public health and economic responses enabled by telecom networks: staying at home, adopting telemedicine, and teleworking. First, based on de-identified data on customer movement and location, this paper estimates that compliance with stay-at-home orders was about 20% lower in the 2nd wave than during the 1st wave, despite much cases counts, suggesting that Canadians suffered from isolation fatigue. Across Canada's six largest cities, controlling for population and GDP per capita, a 1% decrease in compliance is associated with an additional 700 COVID-19 infections. Second, based on data on two telemedicine apps, this paper highlights the potential for the rapid adoption of telemedicine. At the start of the pandemic, adoption of these apps doubled and then was sustained throughout 2020, with usage patterns reflecting digital divides in age and gender. Third, Canada's teleworking rate changed in lockstep with COVID-19 cases, even while the unemployment rate remained constant, suggesting that employers are adopting teleworking as a flexible way to adapt to evolving public health conditions and restrictions without resorting to layoffs. When viewed against this backdrop, telecommunication policy can support public health and social outcomes, in addition to economic outcomes.

1. Introduction

The COVID-19 pandemic—perhaps more than any event in human history—has demonstrated the fundamental importance of telecommunications networks to keep societies connected and running. As governments imposed strict lockdowns requiring physical distancing, telecom networks enabled the continuation of working, learning, socializing, and accessing healthcare from home. Without high-performing networks, the social and economic impact of the pandemic would have been incalculably harsher, and the public health response would have been impossible to execute.

According to the International Monetary Fund, the global economy shrank by about 3.5% during 2020, the greatest decline since the Great Depression ([IMF, 2021](#)) and similar to the decline in the Canadian economy, 3.3% ([Statistics Canada, 2021](#)). These generational contractions in economic activity occurred despite the substantial continuation of working and commerce via teleworking and e-commerce. Moreover, notwithstanding the more than 3.7 million and 25,000 deaths globally and in Canada, respectively ([Our World in Data, 2021](#)), mortality would have been significantly higher without telecommunications networks, which supported digital alternatives to in-person gatherings, healthcare appointments, and other essential interactions ([ITU, 2021](#)). By enabling the rapid communication of essential information about the COVID-19 virus, including about its spread and location, enabled governments to target public health and other interventions ([ITU, 2021](#); [Haug et al., 2020](#)).

This paper uses data from TELUS Communications, a major North American network operator, to examine consumer data use during the pandemic, as well as the role of telecom networks in enabling public health and economic responses to the pandemic such as compliance with stay-at-home orders, telemedicine adoption, and teleworking. Based largely on descriptive statistical analysis, this paper finds:

- Wireline data consumption spiked by 30% at the start of the pandemic, the equivalent of a year's worth of growth in a matter of a few days. Between March and December 2020, wireline data grew by 53% overall in the Canadian provinces of Alberta and British Columbia.
- Although declining by 9% in the first month of the pandemic, wireless data consumption grew by 27% during the pandemic overall, eventually returning to pre-pandemic growth by the end of 2020.
- In February 2021, video streaming services accounted for almost as much data use as all web applications combined.
- Wireline data consumption is growing exponentially, doubling every 1.3 years, vastly outstripping growth in food, energy, and other forms of consumption. If data use continues to grow exponentially, by 2030, one individual consumer will use almost as much data as 200 consumers use today.
- Compliance with stay-at-home orders is much lower in Canada than in leading countries. Compliance was about 20% lower in the 2nd wave than during the 1st wave, despite much higher infection rates, suggests that Canadians suffered from isolation fatigue.

- Canadians spent more time congregating in large groups during the 2nd wave of the pandemic than the 1st wave. Controlling for population and GDP per capita, a 1% increase in social congregation is associated with an additional 700 COVID-19 infections, across Canada's six largest cities.
- The adoption of TELUS telemedicine apps, Babylon and Akira, more than doubled at the start of the pandemic and their usage was sustained throughout 2020. Usage patterns reflect digital divides with older adults about four times less likely to adopt than younger adults, as result of low levels of digital skills, as well as condition that require more in-person.
- Canada's December 2020 telework rate was 31.2% down from a peak rate of 35.2% in May 2020. That teleworking changed in lockstep with COVID-19 cases, even while the unemployment rate remained constant, suggests that employers are adopting teleworking as a flexible way to adapt to evolving public health conditions and restrictions without resorting to layoffs.

In exploring the role of telecommunications in enabling public health and economic responses, the analysis in this paper suggests that telecommunication policy can support public health, social, and environmental outcomes, in addition to economic outcomes.

2. Methods

The data in this paper were provided by TELUS Communications, a larger Canadian network operator.¹ They were collected between December 2020 and March 2021 and include data on: wireline network use, 2017 to 2020; wireless (mobile, fixed wireless), 2019 to 2020; de-identified customer movement and location; and telemedicine adoption². To protect privacy and propriety interest, all data in this paper are de-identified and aggregated. Public health data, on COVID-19 cases and deaths, and economic data, on employment, were collected during the same period from national statistical agencies.

This paper largely presents descriptive statistical analysis, and with the exception of linear regression analysis in Section 4.1.2, does not attempt to empirically test hypotheses. The majority of the analysis derives from a literature review that relates insights from the primary data to broader issues about network use and public health responses during the COVID-19 pandemic. As an initial exploration of the role of telecom networks using unique industry data, it suggests further avenues for research that can contribute to growing body of academic literature about the pandemic ([Chetty et al., 2020](#); [Chiou & Tucker, 2020](#); [Dingel and Neiman, 2020](#)).

3. Networks during and before the pandemic

3.1 Wireline and wireless data consumption during the pandemic

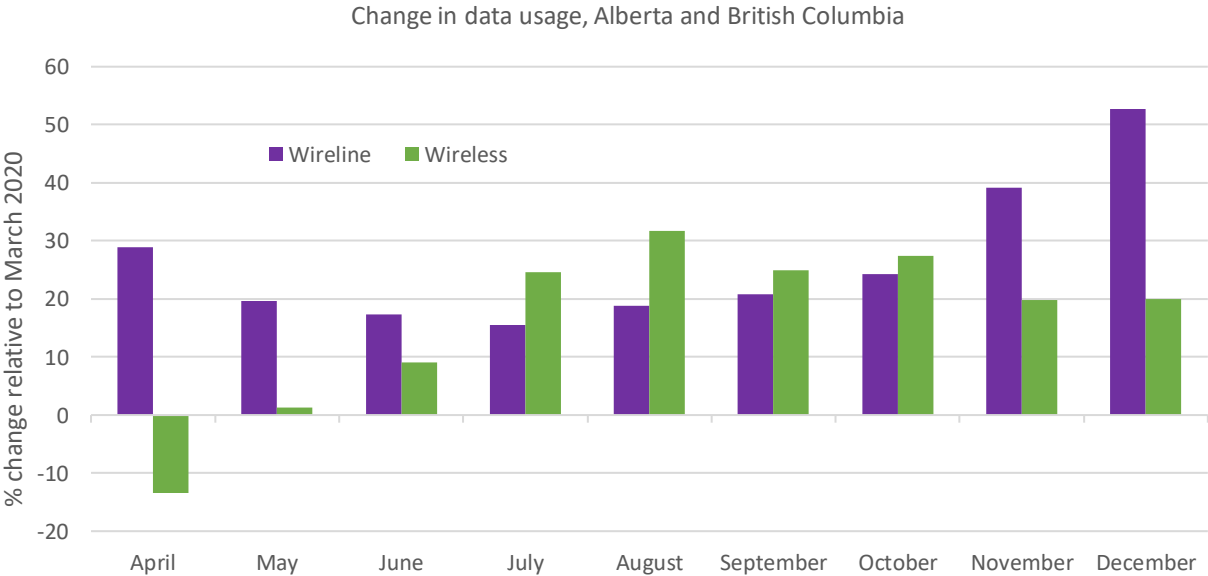
The onset of the COVID-19 pandemic and the scale of public health and economic response are unlike anything witnessed for more than a century (Christakis, 2021). As widespread physical distancing measures were imposed across countries, COVID-19 radically altered individual behaviours and social

¹ <https://www.telus.com/en/about>

² These data are available upon request.

interactions. Practically overnight, citizens in most advanced countries, shifted to working, learning, shopping, and accessing healthcare from home, as well as connecting with friends and family virtually instead of in-person.

These changes in behaviour and interactions leave a signature in network data. Figure 1 presents the percentage change in data usage (consumption), on wireline and wireless networks, by consumers in the Canadian provinces of Alberta and British Columbia.³ Between March and April 2020, as Canadians quickly shifted to working and attending school from home, consumer wireline data consumption spiked by almost 30% within a few days. In fact, this increase was greater than the increase in consumer wireline data consumption during the previous year (25%). A years' worth of growth in a matter of days. Between March and December 2020, wireline data grew by 53% overall.



Change in wireline and wireless data usage in Alberta and British Columbia, 2020

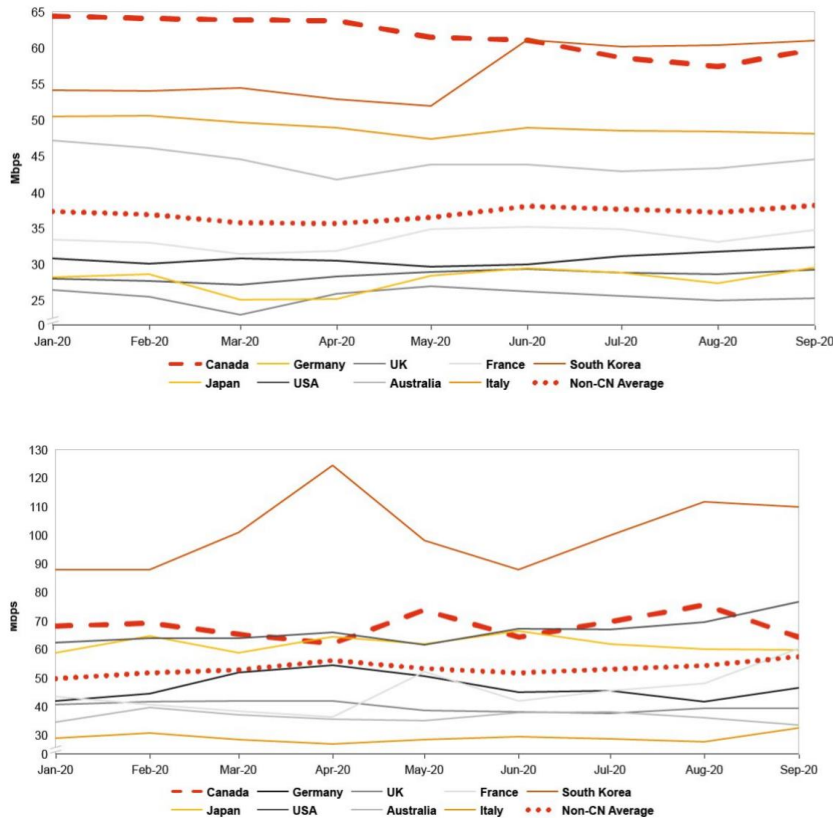
Figure 1

By contrast, mobile wireless data consumption declined by 9% at the start of the pandemic. This reflects that Canadians began to practice physical distancing, avoiding social gatherings and public places where people often use their wireless devices such as in offices, on public transportation, or when waiting in line in the grocery store. With the gradual relaxation of public health restrictions across the country throughout the summer, mobile wireless data consumption increased as people began expanding their social bubbles and returning to public places. Between March and December 2020, wireless data consumption grew by 27%

Throughout the pandemic, wireline and wireless data consumption has reflected changes in behaviour and interactions, rising and falling, respectively, alongside public health restrictions. Despite these sharp

³ Wireless refers to both mobile and fixed wireless.

changes in network usage, as shown in Figure 2, telecom networks in Canada and other advanced countries experienced very little degradation in network quality ([Opensignal, 2020, as cited in PwC, 2021](#)) while supporting an unprecedented increase in network demand at peak periods during the pandemic.

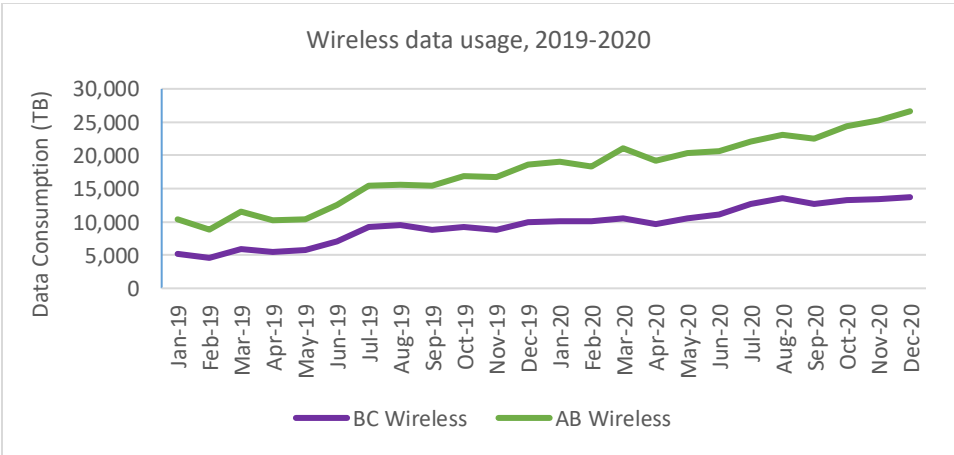
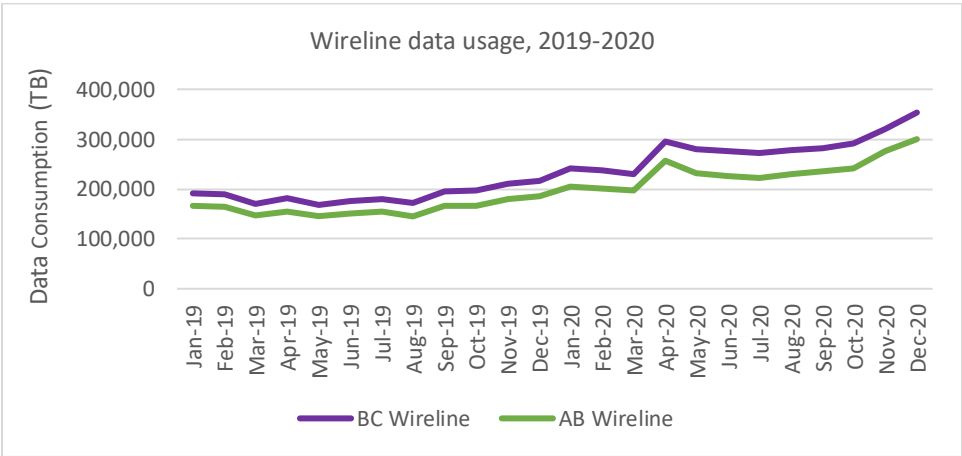


Average monthly download speeds, mobile and fixed networks, G7 countries, Australia, and South Korea
Figure 2

The pandemic slowed the shift in data usage from wireline to wireless that had been occurring pre-pandemic. Wireline data consumption increased 53% between March and December, about 20% more than in the previous ten months, whereas mobile wireless data consumption increased 27%, down from 20% in the previous period.

Despite this reversal, after the pandemic, the shift toward wireless will likely continue. As shown in Figure 3, for the two years between January 2019 and December 2020, mobile wireless data consumption still grew faster (116%) than wireline data consumption (82%). This reflects both improvements in access to wireless networks ([CRTC, 2020](#)) and increasing adoption of wireless devices in Canada ([Statistics Canada, 2021](#)). While more than 98% of residents in Alberta and British Columbia have access to *both* wireline and wireless networks, including 97% in rural communities, only about 80% have mobile data plans and 95% have Internet access at home ([CRTC, 2020](#); [Statistics Canada, 2021](#)).

That the rate of digital adoption is significantly lower than digital access suggests that policies in Canada should focus on addressing digital divides such as providing subsidies for low income consumers and digital training for older adults (Levin et al., 2015). To the extent that access to telecommunications networks is associated with faster GDP or employment growth (Koutroumpis, 2009; Ford, 2020), as well as ability to telework (Dingel & Neimann, 2020) or access telemedicine (Hashiguchi, 2020), policies focused on promoting digital adoption can have significant socio-economic benefits, based on the gap between digital access and adoption.



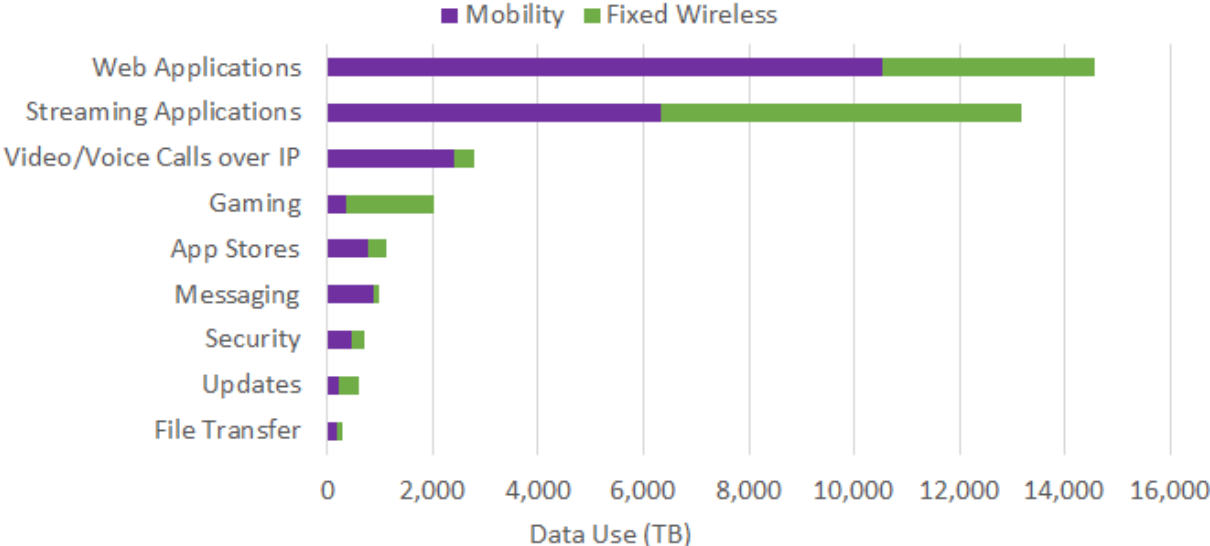
Growth in wireline and wireless data use, Alberta and British Columbia, 2019-2020
Figure 3

3.1.1 Wireless app use in February 2021

Over the last few years, growth in data use on wireless networks has been increasingly driven by streaming. This shift is the result of both the emergence of streaming services such as Netflix, Amazon Prime, and Disney Plus, as well as the sharp decline in the price of data that was a necessary condition for their emergence and use by consumers. Without access to relatively cheap data (i.e., unlimited or near unlimited data plans), watching a movie on Netflix each month would become at least as expensive as a ticket to see it in a theater. For example, watching a 90-minute movie on Netflix would require around

500 MB of data on a 4G LTE wireless network ([CRTC, 2019](#)). Based on data from the Canadian government department of Innovation, Science and Economic Development ([ISED, 2021](#)) 500 MB of data on a 4G BYOD wireless plan in Alberta and British Columbia would cost about \$6.25, much less than a typical movie ticket. With unlimited data, which is an increasingly common attribute of both wireless and wireline plans, the cost of streaming in movie – in terms of data usage – becomes vanishingly small.

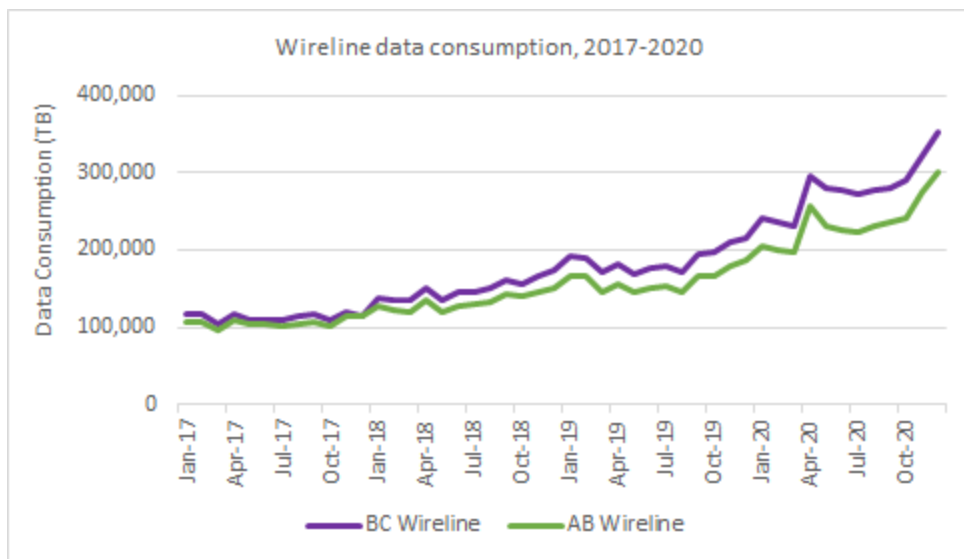
This shift in consumer behaviour can be found in the recent data on application use on national wireless networks across 11 million customers. In February 2021, streaming services accounted for almost as much data use as all web applications combined. Yet, as highlighted Figure 4, wireless data consumption supports a variety of online activities including web browsing, video/voice calling, social media, gaming, and music streaming. As shown in [Jamison & Wang \(2021\)](#), during the pandemic, consumer valuations of digital services such as email, search, and social media increased five-fold. While growth in consumer demand for data is largely driven by streaming, the ways in which Canadians spend their time online is tremendously varied and valuable to consumers.



Data use by type of application, February 2021
Figure 4

3.2 Wireline data use consumption before the pandemic

While the pandemic produced an unprecedented spike, wireline data consumption has been growing exponentially since 2017. As shown in Figure 5, total data consumption in both British Columbia and Alberta grew by more than 200% between 2017-2020, with the majority of this growth driven by greater data usage per subscriber. That growth in data consumption vastly outstrips growth in other categories of household consumption such as shelter, food, transportation, and energy reflects the increasing importance of data to the economy and to society.



Wireline data consumption, British Columbia & Alberta
Figure 5

Data use is growing exponentially, doubling every 1.3 years. If data use continues to grow exponentially, currently doubling every 1.3 years, the amount of data generated within a decade will be mind boggling. For example, at the current growth rate, by 2030, one individual consumer will use almost as much data as 200 consumers use today.

Growth in wireline consumption is consistent with an explosion of data consumption across telecom markets around the world, and more generally with the emergence of data as one of the world’s most valuable resources ([The Economist, 2017](#)). With the data economy expected to generate about \$13 trillion in new global economic activity by 2030 ([Chakravorti et al, 2019](#)), data could determine the next world order, much like the role that oil played in previous decades. Yet unlike oil, data is infinitely durable and reusable and can be moved around the world at the speed of light. An economy driven by such a powerful commodity holds immense promise to revolutionize existing and create new markets at an unprecedented rate.

4. Physical Distancing, Telemedicine, and Teleworking

Looking broadly across countries highlights that high quality telecom networks are a necessary condition for effective economic and public health responses to COVID-19 ([ITU, 2021](#); [Haug et al., 2020](#)). In particular, fast, reliable networks underpin the success and broad acceptance of lockdown measures by enabling substantial continuation of work, education, commerce, and health, notwithstanding physical distancing. When viewed in this light, telecom policy is not only economic policy but also public health, social, and environmental policy. In the next three sections, we consider three examples that highlight the role of telecom networks in the pandemic: enabling physical distancing, telemedicine, and teleworking.

4.1 Physical Distancing

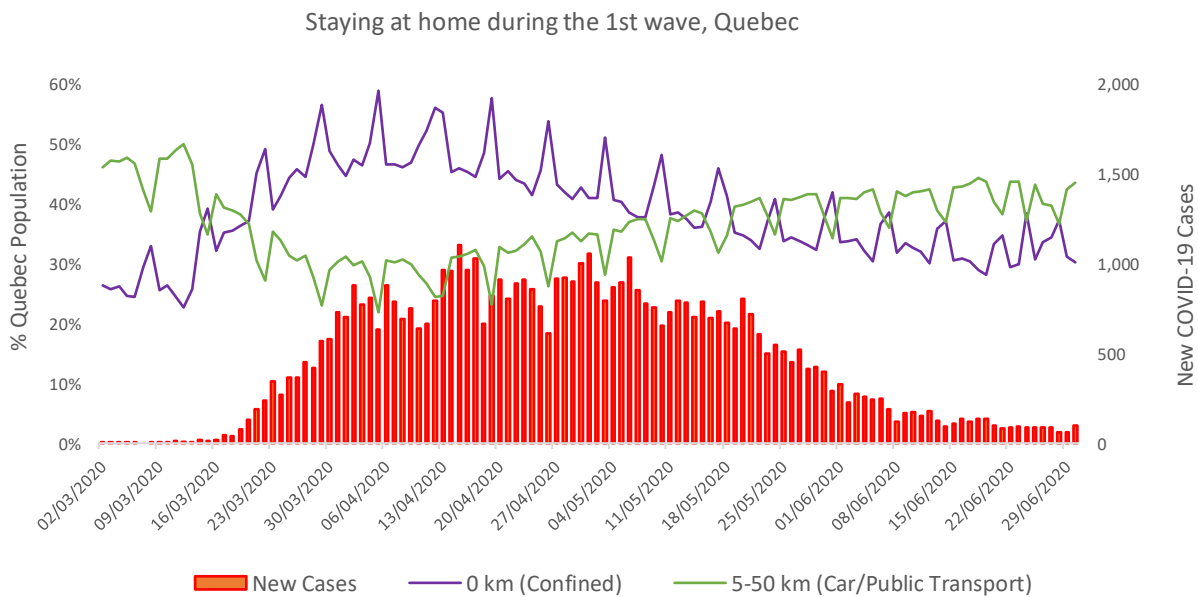
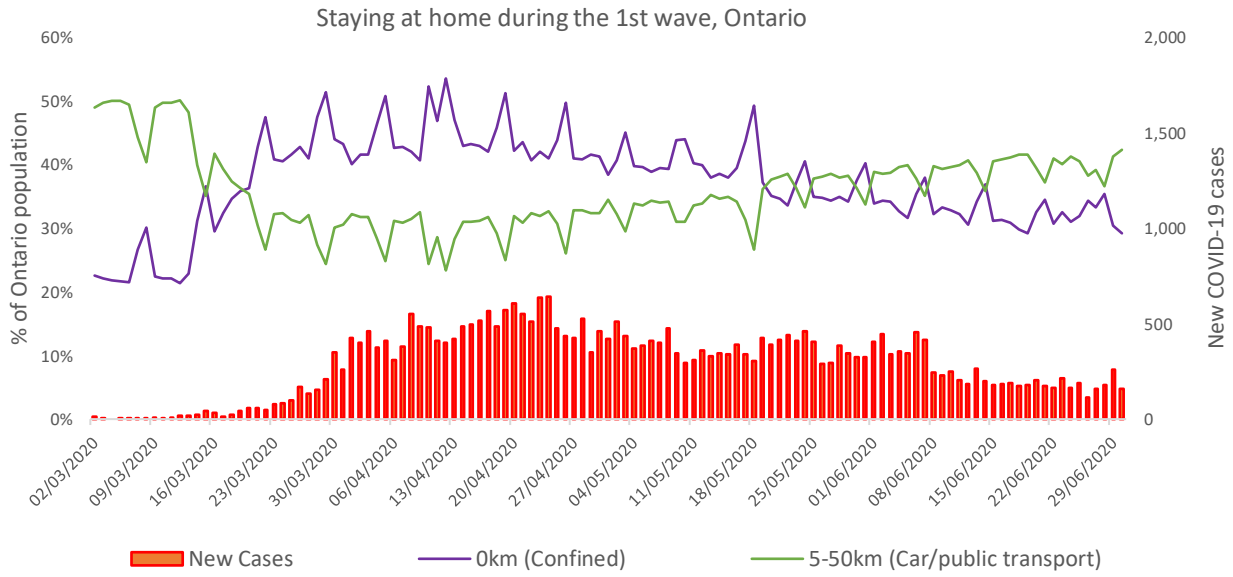
The pandemic is not playing out in the same way from place to place. Infection and mortality rates differ by a factor of more than one hundred between countries with the highest (e.g., Hungary, Belgium,) and lowest rates (e.g., Taiwan, Vietnam) and by a factor of ten even within the EU (e.g., Hungary vs. Czech Republic) ([Our World in Data, 2021](#)). Across countries, public health outcomes are sensitive to the speed, character, and quality of government policy. Early in the pandemic, countries that achieved low mortality rates in East Asia and the EU were able to control the spread of COVID, as well minimize its impact, by following similar public health and economic policies, including early travel restrictions, mass testing and contact tracing, and temporary wage/unemployment benefits ([Haug et al., 2020](#)). Successful countries were able sustain widespread lockdown measures, in part, because of strong telecom networks, which enabled working, learning, shopping, socializing, and accessing healthcare from home ([ITU, 2021](#)).

4.1.1 Stay-at-home orders

Even when accounting for health and economic policies, telecom network performance, and demographic/socio-economic factors, compliance with stay-at-home orders, as well as with quarantine and isolation, is highest in countries with greater degrees of collectivism and social conformity. Across countries, these differences in culture are associated with lower infection rates (by a factor of 5) and lower mortality rates (by a factor of 9) ([Gelfand et al., 2021](#)). For example, in countries such as Taiwan and Czech Republic, where collectivism and social conformity are high, the vast majority of residents, in excess of 90%, strictly followed stay-at-home orders ([Gelfand et al., 2021](#)).

That Canada's infection and mortality rates are greater, by a factor of ten, than in leading countries ([Our World in Data, 2021](#)), reflects cultural differences, as well as differences in policies, networks, and other factors. Using de-identified and disaggregated data on wireless customers of a national network operator, we show that compliance with stay-at-home orders is much lower in Canada than in leading countries. Moreover, we also show that there is variation in the stay-at-home rate, across Canadian provinces (Ontario and Quebec) and between the 1st and 2nd waves.

Figure 6 shows the extent to which people in Ontario and Quebec stayed home during the 1st wave of the pandemic. It compares the *daily average* share of the population that did not leave their home (purple line) to the share that travelled more than 5km (green line), plotted against the daily number of new COVID-19 cases. During the peak of the 1st wave in April, the percentage of people in Ontario who stayed home nearly doubled from pre-pandemic levels, with about 52% of the population adhering strictly to stay-at-home orders. By the end of the 1st wave in June, only about 37% of people stayed home stabilizing at only slightly higher levels than pre-pandemic. As public health restrictions were gradually lifted, people began resuming their regular travel behaviour. Although a similar pattern occurred in Quebec, during the peak of the 1st wave, a greater percentage of the population stayed home (58%) than in Ontario, while stabilizing at the same rate (37%) at the end of the 1st wave. This is despite more than twice as many COVID-19 cases per day in Quebec than Ontario in June 2020.



Staying at home during the 1st wave, Ontario & Quebec

Figure 6

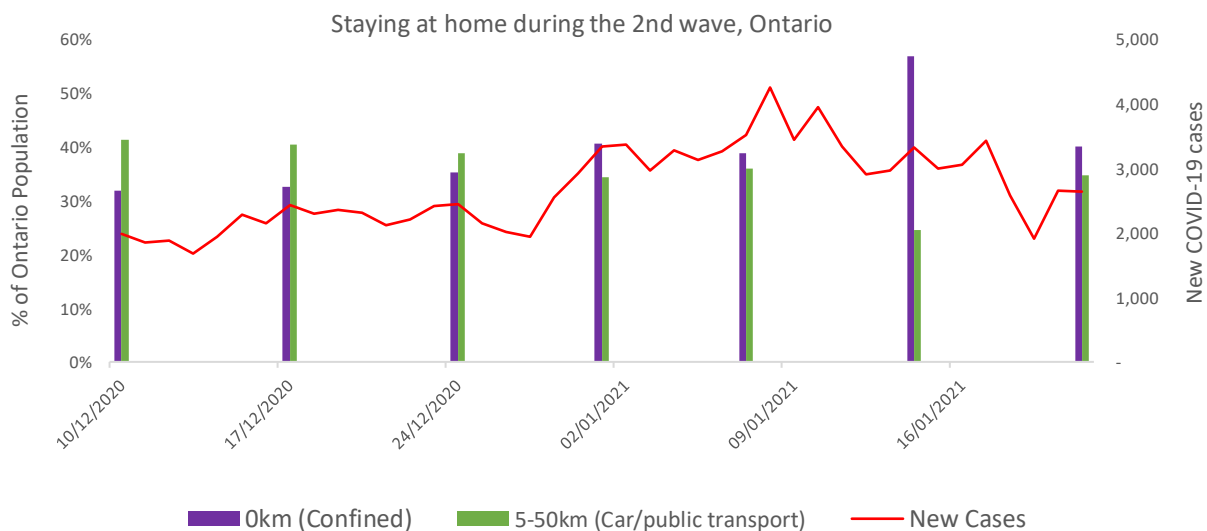
* Data on COVID-19 cases from [University of Toronto database](#).

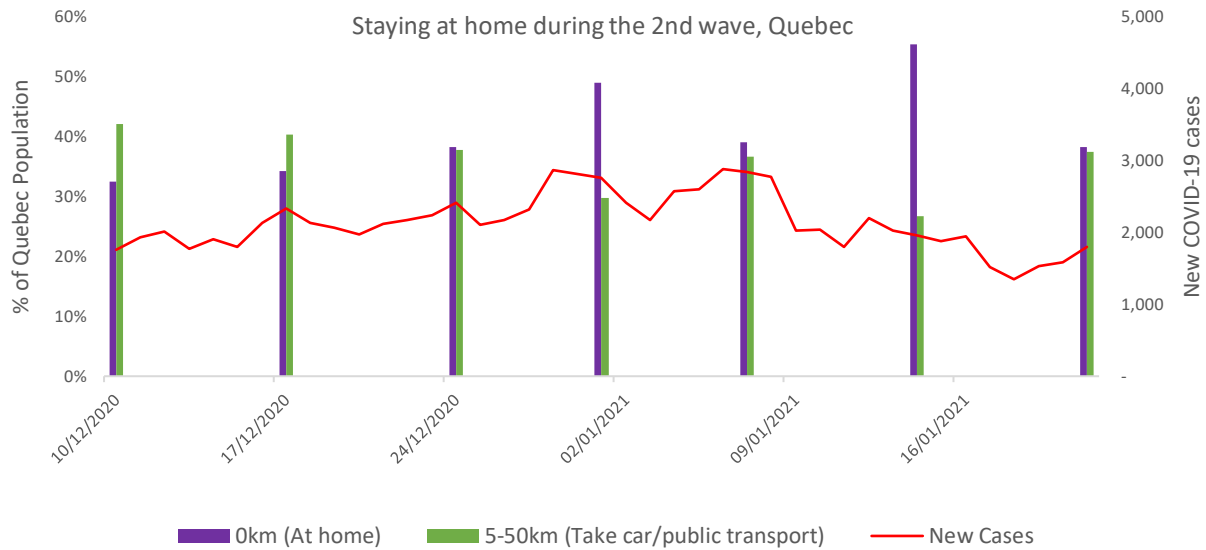
Figure 7 shows compliance with stay-at-home orders during the 2nd wave of the pandemic in Ontario and Quebec. As a result of change in data reporting at the national telecom operator, this figure plots the *weekly average* share of people who did not leave their home (purple bar) and those who travelled more than 5km (green bar), against average daily new COVID-cases. Despite eight-fold and two-fold increases in the number of new daily COVID-19 cases in Ontario and Quebec, respectively, the percentage of the

population staying at home during the 2nd wave remained constant at about 37% - the same share as at the end of the 1st wave.

During the 2nd wave of the pandemic, the *stay-at-home rate* was largely unaffected by government issued stay-at-home orders on December 25 and January 14, respectively, Quebec and Ontario. As shown in Figure 7, despite a jump in adherence immediately following the orders, the stay-at-home rate returned to its previous levels within a week. In a reversal of the 1st wave, Ontarians stayed home at a slightly higher rate than the Quebecers (40% vs. 38%), despite having more than four times as many new cases of COVID-19 in January 2021.

Overall, these data highlight that Canadians, both in Ontario and Quebec, adhered to stay-at-home orders at a rate at least 30% lower than in leading countries with greater degrees of collectivism and social conformity. That compliance with stay-at-home orders was about 20% lower in the 2nd wave than during the 1st wave, despite much higher infection rates, suggests that Canadians suffered from isolation fatigue, with very little change in travel behaviour following new stay-at-home orders. Finally, the differences between Ontario and Quebec in stay-at-home rates – about 6% during the 1st wave and 2% during the 2nd wave – can potentially be explained by differences in culture, but also by differences in public health and economic policies, something we did explore in this paper. The magnitude of these differences in compliance with stay-at-home orders have significant effects on the infection rates, which we explore in the next sub-section





Staying at home during the 1st wave, Ontario & Quebec

Figure 7

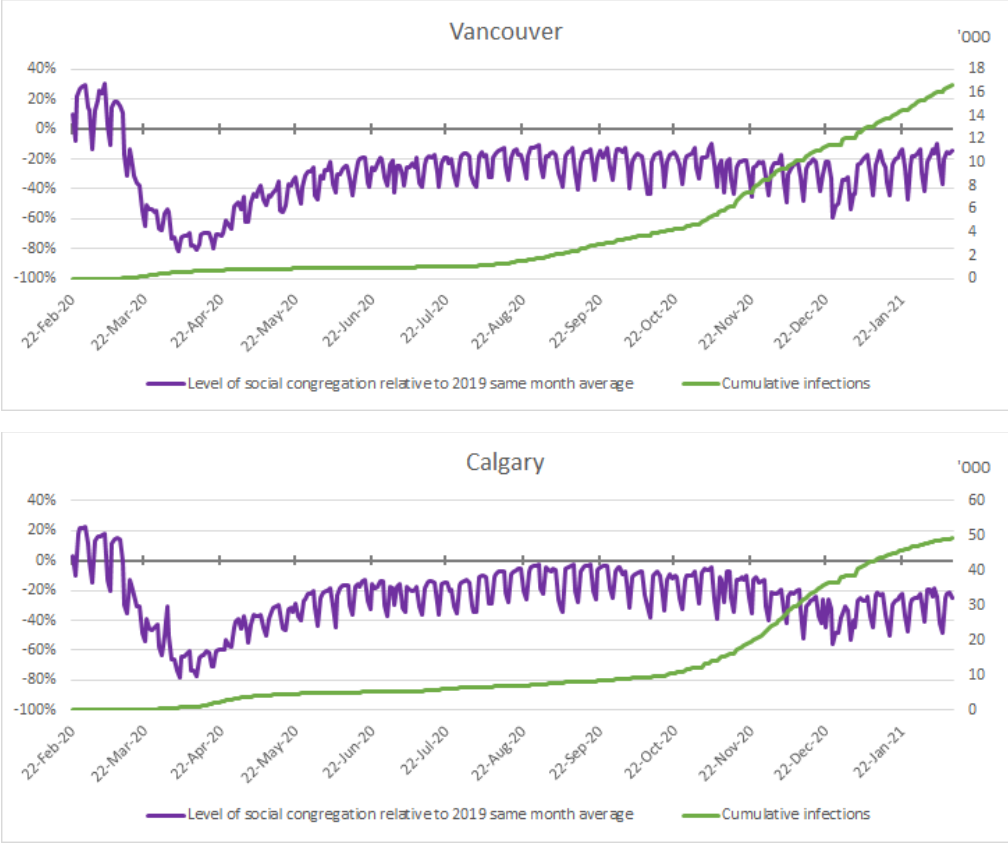
* Data on COVID-19 cases from [University of Toronto database](#).

4.1.2 Social congregation

Avoiding places where large groups of people gather, including public transportation, shopping malls, and indoor events, is one of the most important ways to reduce the rate of COVID-19 infection ([Wong & Collins, 2021](#); [Chande et al, 2021](#)). Using de-identified and disaggregated data on wireless customers of a national network operator, we estimate the change in the level of *social congregation*: the share of the population that congregated in a place, outside their home neighbourhood, with more than 20 people.⁴

As shown in Figure 8, the level of social congregation (purple line) dropped (year-over-year) by 81% and 78% at the peak of the 1st wave of the pandemic in the Canadian cities of Vancouver and Calgary. Then, as was the case with stay-at-home orders in Ontario and Quebec, the behavioural responses weakened during the 2nd wave of the pandemic, with the level of social congregation dropping to only 60% and 55% during the 2nd wave of the pandemic, suggesting isolation fatigue.

⁴ Congregation is based on counts of devices congregating away from their assumed home neighbourhood and in a group of at least 19 other devices. Of the devices not at their home area, it is determined if they were in the same tower sector area with at least 19 other devices at the same time. These counts of devices are then aggregated to the day. This means that a device may be seen congregating multiple times a day but will only be counted as unique once per day.



Year-over-year change in social congregation, Vancouver and Calgary
Figure 8

* Data on COVID-19 cases from [University of Toronto database](#)

Table 1 presents data on Canada’s six largest cities, including infection rates, population, GDP, and changes in social congregation. We estimate that during the 1st wave of the pandemic, Canadians reduced their out-of-home activities by about 74% compared to the previous year. This reduction in average social congregation was driven by people avoiding travelling to the office, shopping at brick-and-mortar stores, and attending social gatherings, instead replacing these in-person activities with teleworking, e-commerce, and video calls. During the 2nd wave, and despite exponential growth in infections, Canadians reduced their out-of-home activities by only about 58% compared to the previous year. This 16% difference in social congregation between the 1st and 2nd waves, reflects several factors including changes in public health guidelines, as well as changes in compliance with and social acceptance of these guidelines.

Table 1
Infections, population, GDP, and social congregation during the pandemic, Canada’s six largest cities

City	Total infections	Infections per million	Population	GDP per capita	Average social congregation (YOY)		
					1 st wave (%)	2 nd wave (%)	Change (%)
Vancouver	16,584	7,322	2,264,823	86,140	-81	-60	-22
Calgary	49,185	39,740	1,237,656	102,060	-78	-56	-22
Edmonton	52,479	49,385	1,062,643	101,190	-75	-58	-17
Toronto	91,469	16,847	5,429,524	83,020	-66	-54	-12
Ottawa	13,815	13,959	989,657	105,050	-67	-57	-10
Montreal	99,771	28,347	3,519,595	82,000	-74	-62	-12
Average	53,884	25,934	2,417,316	93,243	-74	-58	-16

Table 2 presents results from four linear regression models that estimate the effect of social congregation on total COVID-19 infections, controlling for GDP per capita and population. Based on the best fit model, a 1% increase in social congregation is associated with an additional 700 COVID-19 infections. While this is a preliminary finding, it does suggest, nonetheless, that across cities changes in average social congregation – as measured by de-identified and disaggregated information – provide a basis to target government interventions ([Haug et al., 2020](#)) to cities with high or increasing levels of social congregation. This should include clear, credible public health communications about the risks, benefits, and uncertainties of large gatherings of more than 20 people ([Abrams & Greenhawt, 2020](#)).

Table 2
Results from multivariate linear regression analysis

	Model 1	Model 2	Model 3	Model 4
Constant	92881.4*** (8.91)	267261.5** (1.91)	30887.5** (2.87)	27621.6** (2.03)
Social congregation	-2463.0* (-2.71)	-2003.1* (-2.21)	-720.6* (-2.04)	-707.6* (-2.45)
GDP per capita		1.9 (-1.33)		0.0286 (0.01)
Population			0.014*** (4.70)	0.015*** (4.80)
R-squared	0.351	0.378	0.534	0.548
No. observations	335	335	335	335

T-statistics are presented in parenthesis

*, **, and *** represent significance at the 90%, 95%, and 99%, respectively

4.2 Telemedicine

The COVID-19 pandemic is unlike any previous pandemic. The ubiquity of international travel, the ease of transmission of the virus, and symptom variability have resulted in an unprecedented rate of spread. The need for physical distancing has also led to the rapid adoption of telemedicine solutions globally ([Hashiguchi, 2020](#)). About 50% of Canadians report receiving virtual medical care at some point during the pandemic, compared to just 4% before the pandemic ([Canada Health Infoway, 2020](#))

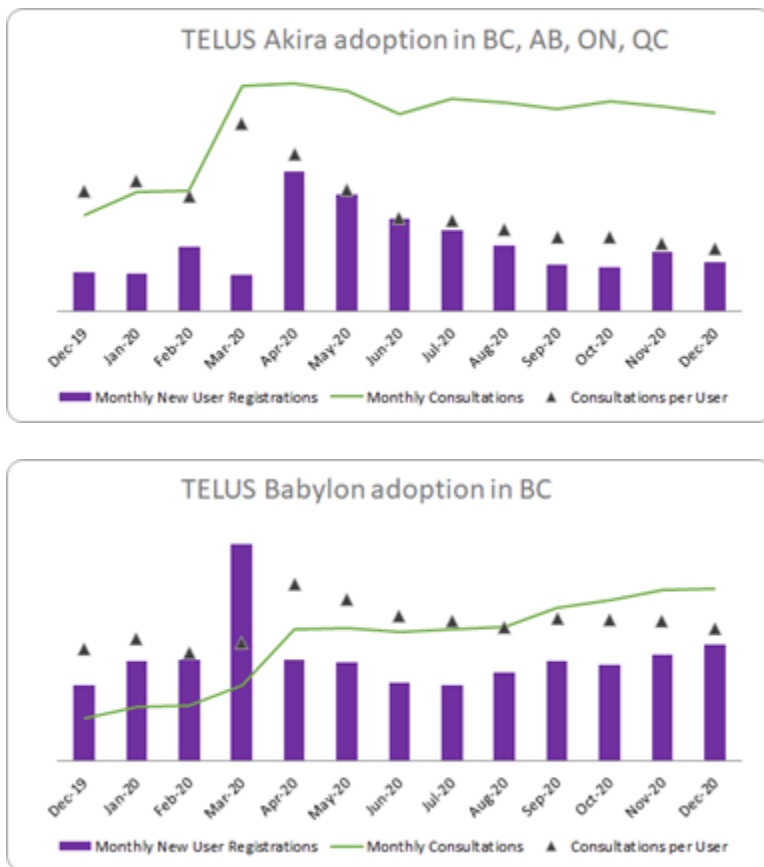
Telemedicine – the use of information and communication technologies (ICT) to deliver healthcare services over distance – has three roles in reducing the spread of infections. First, by enabling physical distancing, telemedicine enables patients to maintain access and continuity of medical care while reducing the potential for the spread of the virus in clinics, hospitals, and long-term care facilities, as well as in the community more generally. Second, by helping to track symptoms across people who use telemedicine, the digital capture and selective sharing of data facilitate surveillance at regional, national, and international levels. Public health surveillance is fundamental to successful public health responses to infectious disease, allowing for targeted use of resources by providing up-to-date and accurate public health data (subject to adherence to privacy legislation and guidelines) ([WHO, 2020](#)). Third, by supporting policy makers in anticipating future health needs, telemedicine can support timely public health interventions and help prevent future outbreaks ([Blandford et al., 2020](#)).

Consistent with these findings, we show a spike in adoption for two TELUS Health telemedicine services, Babylon by TELUS Health (Babylon) and Akira Health. Because of privacy commitments and propriety concerns, measures of telemedicine adoption – new registrations, consultations, and consultations per user – are presented in terms of change, without a base number of users.

First, Babylon is a mobile app that allows users to check symptoms, consult doctors, and access clinical records. Between February and April 2020, the number of monthly consultations more than doubled (137% increase) and remained at this level throughout 2020 (see Figure 9). This increase in adoption was the result of both new user registrations in March (120% increase) and higher average consults per user in April (48% increase). Second, Akira Health, a mobile telemedicine app provided as part of employee healthcare plans, saw an 86% spike in March 2020, driven mainly by an increase in average consultations per user (64%) (see Figure 9). By contrast with Babylon, which is a publically available app, Akira Health is limited to employees enrolled in healthcare plans.

The adoption of telemedicine must contend with digital divides, whereby potential users face barriers related to network access and socio-economic factors. Telemedicine adoption, like most ICT adoption, tends to be lower among older people, low income communities, people with disabilities, and across other demographic and socio-economic groups. There is evidence of a digital divide in the use of TELUS Health apps. For Babylon, older adults are four times less likely to register for Babylon than younger adults (between 20-59 years old) and about three times less likely to use the app for a consultation. This is due to several factors including digital literacy, as well conditions that require more in-person care. Similar to most healthcare services, across both Babylon and Akira, women are more likely to adopt than men, accounting for about two thirds of all consultations.

Encouraging the adoption of telemedicine is good public health policy, both during and after the pandemic. In addition to helping reduce COVID-19 infections during the pandemic, there are likely to be significant long term health benefits associated with a greater adoption of telemedicine including improved patient outcomes, lower healthcare costs, higher labour productivity, and greater equality across social groups. But a substantial number of technical and policy barriers hinder the adoption of telemedicine in Canada including software design, national standards, physician compensation, and digital divides. The long term benefits to Canada are substantial with RAND (forthcoming) estimating the economic impact to be in the range of 2% of Canada’s total healthcare spending. In this sense, encouraging telemedicine is also a good economic policy.



Adoption of Babylon and Akira telemedicine services
Figure 9

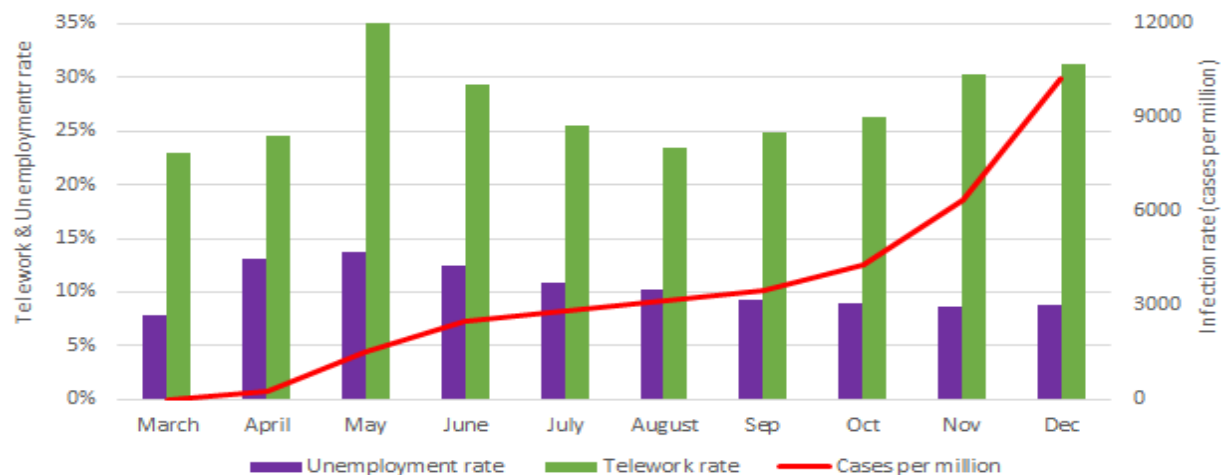
4.3 Teleworking

Before the pandemic, about 20% of the Canadian labour force worked remotely at least one day per week ([Statistics Canada, 2021](#)). This rate is well-below the estimated share of the jobs – between 35% to 40% - that can, in practice, be performed at home ([Dingel and Neiman, 2020](#)). As shown in Figure 10, within two months of broad lockdown measures, the telework rate jumped to the estimated long-run rate, with about 35% of the Canadian workforce working from home (around 6.1 million people). The telework rate

as estimated by TELUS data is consistent with estimates from the Statistics Canada ([Statistics Canada, 2021](#)).

Figure 10 shows that teleworking increased during the 1st wave, declined during the summer⁵, and then increased again during the 2nd wave pandemic while the unemployment rate remained constant. As of December 2020, 31% of the Canadian workforce was teleworking – about 5.4 million people – with the unemployment rate remaining nearly constant at around 9% throughout the 2nd wave ([Statistics Canada, 2021](#)). That teleworking changes in lockstep with COVID-19 case counts suggests it is a flexible way for businesses to adapt to changing public health conditions and restrictions without resorting to layoffs. Without telecom networks to enable working from home, unemployment almost certainly would have been much higher throughout the pandemic, worsening what has already been the most significant economic crisis since the Great Depression.

Widespread telework may remain a permanent feature of the future working environment, catalyzed by widespread lockdown measures during the pandemic but maintained for productivity and climate benefits. Because the telework rate varies substantially across industries, companies, and job types, there is a wide scope for economic policies to contribute to the spread of teleworking. For example, policy makers can promote the diffusion of digital skills, investments in home offices, and the adoption of high-speed Internet services ([OECD, 2021](#)). As teleworking supports reductions in GHGs emissions associated with the commuting, these policies designed to encourage teleworking can have a major role in helping Canada meet its international climate obligations (Pembina Institute, forthcoming).



Change in unemployment and telework rates during the pandemic
Figure 10

* Data on COVID-19 cases from [Our World in Data](#).

⁵ The decline in teleworking during the summer reflects people returning to their physical work locations. As the telework rate is calculated using the unemployment rates, changes may also reflect people returning to work who were previously at home but not unemployed (e.g., paid leave). There is also some measurement error associated with assigning work locations to semi-permanent locations such as cottages and vacation homes.

5. Conclusion

Vaccine rollout is well underway in Canada and other advanced countries, leading some people to assume that the pandemic is ending. But that's not the case. To end the pandemic, the virus must either be eliminated worldwide — which most scientists agree is near-impossible because of how widespread it has become — or people must build up sufficient herd immunity through mass vaccination, which is at least potentially 3 years away globally. COVID-19 is here to stay for the foreseeable future.

The evidence presented in this paper report has showcased the exponential growth in data consumption before and during the pandemic, highlighting the critical role of telecom networks, specifically, in enabling physical distancing, telemedicine, and teleworking. These public health responses require the pervasive presence of strong networks. More generally, COVID-19 has irrevocably changed the way that we work, learn, conduct business, obtain health services, socialize, and interact, with all of these activities becoming increasingly digital-first. When viewed against this backdrop, telecommunication policy can support public health and social outcomes, in addition to economic outcomes.

References

- Abrams, E. & Greenhawt, M. (2020). Risk communication during COVID-19. *The Journal of Allergy and Clinical Immunology*, 8(6), 1791–1794.
- Blandford, A. *et al.* (2021). Opportunities and challenges for telehealth within, and beyond, a pandemic. *The Lancet Global Health*, 8(11), e1364 - e136.
- Canada Health Infoway. (2020). *Canadians' Health Care Experiences During COVID-19*. <https://www.infoway-inforoute.ca/en/component/edocman/resources/reports/benefits-evaluation/3828-experiences-of-health-care-during-covid-19-reported-by-canadians>
- Chakravorti, B., Bhalla, A., & Chaturvedi, R. (2019). Which Countries Are Leading the Data Economy? *Harvard Business Review*.
- Chande, A., *et al.* (2020). Real-time, interactive website for US-county-level COVID-19 event risk assessment. *Nature Human Behaviour*, 4, 1313-1319.
- Chetty, R., *et al.* (2020). *The Economic Impacts of COVID-19: Evidence from a New Public Database Built Using Private Sector Data*. NBER working paper No. 27431.
- Chiou, L. & Tucker, C. *Social Distancing, Internet Access and Inequality*. Available at SSRN: <https://ssrn.com/abstract=3568255>
- Christakis, N. (2020). *Apollo's Arrow*. Little Brown and Company.
- Canadian Radio-television and Telecommunications Commission (2020). *Communications Monitoring Report*. <https://crtc.gc.ca/eng/publications/reports/policymonitoring/2020/index.htm>
- Dingel, J. & Neiman, B. (2020). How many jobs can be done at home? *Journal of Public Economics*, 189.
- The Economist. (2017). The world's most valuable resource is no longer oil, but data. <https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data>
- Ford, G. (2020). COVID-19 and Broadband Speeds: A Multi-Country Analysis. Phoenix Center Policy Bulletin, No. 49
- Gelfand, M., *et al.* (2021). The relationship between cultural tightness-looseness and COVID-19 cases and deaths: a global analysis. *Lancet Planet Health*. 5(3), e135-e144.
- Hashiguchi, T. (2020), "Bringing health care to the patient: An overview of the use of telemedicine in OECD countries", *OECD Health Working Papers*, No. 116.
- Haug, N., Geyrhofer, L., Londei, A. *et al.* Ranking the effectiveness of worldwide COVID-19 government interventions. *Nature Human Behaviour*, 4, 1303–1312.

Innovation, Science and Economic Development. (2021). *Telecom quarterly report: Price collection data*. https://www.ic.gc.ca/eic/site/143.nsf/eng/h_00005.html

International Monetary Fund. (2021). *World Economic Outlook Update*. <https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update>

International Telecommunications Union. (2021). *Pandemic in the Internet age: From second wave to new normal, recovery, adaptation and resilience*. ITU. <https://www.itu.int/en/myitu/Publications/2021/05/11/08/52/Pandemic-in-the-Internet-age>

Jamison, M. & Wang, P. (2021). Valuation of digital goods during the coronavirus outbreak in the United States. *Telecommunications Policy*, 45(5).

Koutroumpis, P. (2009), The economic impact of broadband on growth: A simultaneous approach, *Telecommunications Policy*, 33 (9). 471-485

Levin, S, Schmidt, S. & Scott, G. (2015). Broadband for all: Policies for a connected society. *2015 Regional Conference of the International Telecommunications Society (ITS)*

PricewaterhouseCoopers. (2021). *COVID's Impact on Connectivity*.

Nowland, R., Necka, E., and Cacippo, J. (2018). Loneliness and Social Internet Use: Pathways to Reconnection in a Digital World? *Perspectives on Psychological Science*, 3(1), 70-87.

OECD. (2020). Productivity gains from teleworking in the post COVID-19 era : How can public policies make it happen? <https://www.oecd.org/coronavirus/policy-responses/productivity-gains-from-teleworking-in-the-post-covid-19-era-a5d52e99/>

Statistics Canada. (2021a). *COVID-19 in Canada: A One-year Update on Social and Economic Impacts*. <https://www150.statcan.gc.ca/n1/pub/11-631-x/11-631-x2021001-eng.htm#a4>

Statistics Canada. (2021b). *Access to the Internet in Canada, 2020*. <https://www150.statcan.gc.ca/n1/daily-quotidien/210531/dq210531d-eng.htm>

Statistics Canada. (2021c). *Percentage of workforce teleworking or working remotely, and percentage of workforce expected to continue teleworking or working remotely after the pandemic, by business characteristics*. Table 33-10-0247-01

Statistics Canada. (2021c). *Labour force characteristics by province, monthly, seasonally adjusted*. Table 14-10-0287-03

Stockwell, S., Stubbs, B., Jackson, S., Fisher, A., Yang, L., & Smith, L. (2020). Internet use, social isolation and loneliness in older adults. *Ageing and Society*, 1-24.

Our World in Data. (2021). *Coronavirus (COVID-19) Deaths*. <https://ourworldindata.org/covid-deaths>

Wong, F. & Collins, J. Evidence that coronavirus superspreading is fat-tailed. *Proceedings of the National Academy of Sciences*, 117 (47) 29416-29418.

World Health Organization. (2020). *Public health surveillance for COVID-19: interim guidance*. <https://www.who.int/publications/i/item/who-2019-nCoV-surveillanceguidance-2020.8>