



# Rural use of health service and telemedicine during COVID-19: The role of access and eHealth literacy

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## Abstract

The COVID-19 pandemic has driven a greater reliance on telemedicine, yet rural access, use, and satisfaction with telemedicine and the role of eHealth literacy are unknown. Using a cross-sectional design, 279 (70.6% female) western rural Canadians completed an online survey. The majority of participants reported access to telemedicine, but nearly 1/5 lacked access to online or virtual mental health services. The majority of participants had used health care services following the declared COVID-19 pandemic in North America, and just under half had used telemedicine. Telemedicine satisfaction scores were higher among participants who had used video ( $M=4.18$ ) compared to those who used phone alone ( $M=3.79$ ) ( $p=0.031$ ). Telemedicine satisfaction and eHealth literacy were correlated ( $r=0.26$ ,  $p=0.005$ ). Participants did not want telemedicine to replace in-person consultations. Telemedicine practice requires that rural residents have the resources, ability and willingness to engage with remote care.

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## Keywords

COVID-19, eHealth literacy, mental health, telehealth, telemedicine

## Background

Well known health and health care disparities characterize at-risk populations in rural settings. Poor mental health, unhealthy behaviors (e.g. smoking), obesity, chronic diseases (e.g. cardiovascular disease, diabetes), lower life expectancy, and potentially avoidable mortality are higher in rural and remote areas than urban areas.<sup>1</sup> Despite these greater needs, rural populations/communities face disparities in their access to health care such as physician (primary, specialist) shortages, lack of health care facilities, services and equipment, and inadequate infrastructure.<sup>2,3</sup>

Prior to the COVID-19 pandemic, telemedicine was touted as a promising solution to address these rural inequities and increase the quality and accessibility of health care. For our purposes, and following the World Health Organization, telemedicine is used interchangeably with telehealth and defined according to four elements: provides clinical support; connects users from different locations; uses information and communication technologies; and orients to health outcomes.<sup>4</sup> Developments in remote monitoring and sensor technology have further advanced telemedicine practice providing applications for diagnosis, disease surveillance and treatment support.<sup>5</sup> Indeed, the benefit of using technology in the delivery of mental health services to rural areas has been well documented.<sup>6</sup> So too, cloud-based solutions have been effectively used to link rural patients with medical consultants through intermediary health care and community clinic workers.<sup>7</sup>

Despite its potential, pre-COVID-19 telemedicine uptake was slow and below expectation.<sup>8</sup> Pre-COVID-19 evidence indicates that rural residents have lowered amenability and preference for telehealth services when local services are available (e.g. hospitals, clinics).<sup>9-11</sup> How COVID-19 imposed restrictions on access to these services, and disruptions in usual rural primary care with the abrupt switch to telemedicine, have influenced rural residents' satisfaction with telemedicine is unknown.

Although rural uptake was low, pre-COVID-19 satisfaction with telemedicine has been found to be high among patients from rural and remote areas.<sup>12</sup> Orlando et al.,<sup>12</sup> found high levels of satisfaction (system experience, information sharing, consumer focus and overall satisfaction) with telehealth videoconferencing among patients and caregivers living in rural and remote communities who had outpatient appointments from their local health care center with a health care provider at another center. Harkey et al.<sup>13</sup> found patients living in rural areas had high levels of satisfaction with telehealth services for occupational therapy, physical therapy or physiotherapy, and speech-language therapy compared to in-person care. These telemedicine uses were largely for specialist care and did not necessarily reflect the massive shift that occurred with the COVID-19 pandemic that catalyzed telemedicine into all areas of practice including primary care where it had not been routinely used.

It is important to understand rural citizens' use of, and satisfaction with telemedicine during COVID-19, especially as some have projected that post-pandemic, telemedicine will become the new normal in health care delivery.<sup>14</sup> A recent survey suggested that patient satisfaction with telemedicine was high following COVID-19<sup>15</sup>; however, this finding was not specific to rural communities who face different challenges than their urban counterparts. For example, reliance on telemedicine used to its full capacity (e.g. video) requires adequate broadband access, which is often limited in rural and underserved settings.<sup>16</sup> In urban Canadian communities high-speed internet doubled to 51.5Mbps in 2020, while in rural communities it plateaued at 5.5Mbps,<sup>17</sup>

potentially impacting the type and quality of telemedicine care rural people receive and influencing their satisfaction with this care modality.

Another factor that impacts users' ability to use, and satisfaction with, telemedicine is electronic health (eHealth) literacy (defined as the ability to find, use and apply health information from electronic sources<sup>18</sup>). In their study of the eHealth literacy and communication technology use of remote Hawaiian community members, Witten and Humphry<sup>19</sup> found that the eHealth literacy of this population appeared insufficient for proper understanding and utilization of technology. Although not rural-centric, a systematic review of telemedicine adoption suggested that low eHealth and/or a lack of computer literacy prevailed as barriers to widespread implementation.<sup>20</sup> Indeed, eHealth literacy has largely been overlooked in the development of technology-based health interventions, limiting accessibility.<sup>21</sup> Despite the fact that the COVID-19 pandemic has driven a massive shift to telemedicine to decrease person-to-person contact, and slow the spread of the virus,<sup>22,23</sup> no research could be found examining the association between eHealth literacy and telemedicine satisfaction among rural patients. Overall, more research is needed examining rural access, use of, and satisfaction with telemedicine during the COVID-19 pandemic, as well as exploring the role of eHealth literacy in patient satisfaction with telemedicine.

The purpose of this study was to describe rural health service and telemedicine usage and satisfaction in rural communities during COVID-19 as well as to explore the role of eHealth literacy in telemedicine satisfaction and gather participants suggestions for improving rural telemedicine delivery.

## Research questions

1. What proportion of rural community participants accessed health services, mental health services, and telemedicine during COVID-19?
2. How satisfied are rural community members with telemedicine?
3. How is telemedicine satisfaction related to eHealth literacy?
4. What suggestions do participants have for improving telemedicine in rural areas?

## Methods

### *Study design and participant recruitment*

This study employed a cross-sectional online survey from May 29 to July 8, 2020. Participation was open to all rural British Columbia community members; however, recruitment efforts targeted those communities where medical services were provided through one of the provincial health regions. The health authority covers a large geographical mass encompassing both urban and rural and remote communities. However, only adults (19 years or older) living in or near a community that would be considered rural or remote (e.g. population less than 12,000<sup>1</sup>) were included. Recruitment efforts involved social media posts (Kijiji, Facebook, Twitter), announcements in rural community association newsletters, advertisements on rural British Columbian websites, and email invitations sent through community networks. To promote participation, three CA\$100 and one CA\$400 draw prize incentives were advertised. Participants provided online informed consent before proceeding to the online survey. The survey used a combination of fixed and open responses. This study was reviewed and received ethics approval by the University of British Columbia Research Ethics Board (#H20-01166).

## Measures

*Demographic characteristics of participants.* Demographic data collected from all participants included: age, gender, ethnicity/race, and education. We also asked the participants to indicate their community name, and categorized these based on the health authority responsible for health services.

*Health care service use.* To measure health care service use, participants were asked to answer whether they had a need for health services (e.g. hospital, family doctor, HealthLinkBC<sup>ii</sup>) during the COVID 19 pandemic (i.e. since March 18). Those who responded affirmatively were then asked about the frequency of their communication with health care providers since March 18 based on a 5-point scale ranging from Far less often (1) to Far more often (5). Finally, the same group of participants were asked to indicate how they had communicated with their health care providers by checking all that apply: In person, telephone, email, text message, social media (Facebook), Telehealth/eHealth, HealthLinkBC, video-conference (e.g. Zoom, Skype), website, or “I have not communicated with doctors, health care providers or HealthLinkBC during the COVID-19 pandemic.”

*Health service access and frequency of use.* Participants were also asked a series of questions about which services they had access to such as: Telemedicine, online mental health programs, virtual or phone mental health services (e.g. connecting with someone). Additionally, they were asked how often they used these same services during, compared to before, the pandemic.

*Telemedicine use and satisfaction.* To understand participants’ engagement with telemedicine, participants were provided with a definition of telemedicine, and asked “*Have you used telemedicine?*” (yes/no). Those who indicated “Yes” were asked to complete an additional four-items from the Telemedicine Satisfaction Questionnaire (TSQ).<sup>24</sup> These included: “*I feel comfortable communicating with my health-care provider via telemedicine*”; “*I find telemedicine an acceptable way to receive health-care services*”; “*I will use telemedicine services again*”; and “*Overall, I am satisfied with the quality of service being provided via telemedicine.*” Participants responded to each item on a scale ranging from Strongly disagree (1) to Strongly agree (5). An overall telemedicine satisfaction score was created by taking the mean of the four telemedicine satisfaction items. In previous research, the full 14-item TSQ has demonstrated preliminary validity and reliability.<sup>24</sup>

*eHealth literacy.* Participants were asked to complete an 8-item (e.g. “*I know what health resources are available on the internet*”) electronic Health Literacy Scale (eHEALS).<sup>18</sup> The eHEALS is “a measure of eHealth literacy developed to measure combined knowledge, comfort, and perceived skills at finding, evaluating, and applying electronic health information to health problems” (p. 1).<sup>18</sup> Previous research using the eHEALS has demonstrated moderate test-retest reliability, good internal consistency and construct validity.<sup>18,25</sup> Participants responded to items on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). An eHealth literacy score was created by summing the eight eHEALS items (possible range 8–40).

*Telemedicine experiences and suggestions.* In addition to the quantitative measures, participants who responded that they had used telemedicine, were asked to respond to an open-ended question about their experiences with telemedicine. We also invited them to provide suggestions to improve telehealth services in rural communities.

## Data analysis

Descriptive statistics (frequencies and means/SDs) were used to summarize the data. Pearson's Chi-square tests, which evaluate whether categorical variables are related or independent by testing the goodness of fit between actual and expected frequencies on another categorical variable<sup>26</sup> were used to examine telemedicine use (yes/no) by gender (male/female). Independent samples t-tests, which examine statistically significant differences between the means of two unrelated groups,<sup>27</sup> were used to investigate age differences in use of telemedicine (yes/no), and whether telemedicine satisfaction differed by gender (male/female) or modality (telephone versus videoconference). Correlations were used to examine relationships between telemedicine satisfaction and age, as well as telemedicine satisfaction, and eHealth literacy. Spearman's Rho coefficients were reported because the telemedicine and digital literacy response scale were ordinal. Open-ended responses were coded, and thematic analysis was used to determine themes. Quantitative data were analyzed using IBM SPSS Statistics 26 and NVivo 12 was used to analyze the qualitative data.

## Results

Online surveys were completed by 279 participants (70.6% female) between May 29-July 8, 2020 (6 weeks). The mean participant age was 49.45 years (SD = 14.66). The majority of our participants were middle-age and older adults (71%), Caucasian (75%), with trade certification/diploma or a university degree, (>80%), and self-reported good to excellent health (85%). See Table 1 for a summary of participant characteristics.

In total, 185 (66.3%) responded "yes" they had needed health care services during the COVID-19 pandemic. Approximately half of these participants indicated that their frequency of communication with health care providers was "about the same" during COVID-19 compared to before (see Table 2). Twenty-two percent of participants had communicated somewhat/far less often, and in some cases, this reduced frequency carried over into pressing issues such as a "lump in my breast because I feel I won't have access to a mammogram right now." In contrast, 27.6% of participants had communicated somewhat/far more often during COVID-19 than before. The most frequent mode of communication with health care providers during COVID-19 was telephone, followed by in-person, and video-conference (See Table 3). Despite the fact that this question was only answered by participants who had indicated a need for health care services during the COVID-19 pandemic, 8.6%, had not communicated with health care providers.

The majority of participants reported having access to telemedicine (See Table 4). Although 18% reported they did not have access to online mental health programming, and 14% did not have access to virtual or phone mental health services, it is important to note that 38% and 44% did not respond either yes or no to these two questions, respectively (see Table 4). In total, 120 (44.1%) of participants responded "yes" they had used telemedicine. The proportion of males (45%) who had used telemedicine was not significantly different from the proportion of females (43%) who had used telemedicine,  $\chi^2=0.87, p=0.834$ . Age did not differ among those who had used telemedicine ( $M=51.15$  years) and those who had not ( $M=48.38$  years),  $t(247)=1.49, p=0.138$ . In terms of frequency of use, 31% of participants reported using telemedicine somewhat and far more often since the start of COVID-19; likewise, 3.6% and 12.2% of participants reported using online or virtual mental health services somewhat more or far more often since COVID-19, respectively (See Table 5).

Two-thirds of participants reported that telemedicine was an acceptable service model and were satisfied with the quality. Three quarters of participants felt comfortable using telemedicine and nearly 90% would use telemedicine again (See Figure 1). When the four satisfaction items were summed, 74 (62.7%) of the participants scored a four or higher (i.e. agreed, or strongly agreed).

**Table 1.** Sample demographics.

Sample characteristics	<i>n</i>	%
Age grouping (range: 19–85)		
19–35 years	57	20.4
36–54 years	95	34.1
55+ years	103	36.9
Missing	24	8.6
Gender		
Female	197	70.6
Male	72	25.8
Other	1	0.4
Prefer not to answer	2	0.7
Missing	7	2.5
Education		
Some high school or less	9	3.2
Completed high school	44	15.8
Trades certification/diploma	124	44.4
University degree	101	36.2
Missing	1	0.4
Ethnicity/race		
First nation	17	6.1
Metis	7	2.5
Asian/South Asian	9	3.2
Caucasian	210	75.3
First nNation/Metis and Caucasian	12	4.3
Other (e.g. African, Polish, South American)	18	6.5
Missing	6	2.2
Do you identify as a person with a disability?		
Yes	37	13.3
No	233	83.5
Prefer not to answer	7	2.5
Missing	3	1.1
In general would you say your health is. . .?		
Excellent	27	9.7
Very good	102	36.6
Good	107	38.4
Fair	31	11.1
Poor	10	3.6
Prefer not to answer	2	0.7
Health authority		
Interior health	245	87.8
Northern health	23	8.2
Vancouver island health	6	2.2
Vancouver coastal health	2	0.7
Fraser health	2	0.7
Missing	1	0.4

**Table 2.** How often participants communicated with health care providers during COVID-19 compared to before.

How often have you communicated with your doctor/health care provider during COVID-19 compared to before?	<i>n</i>	%
Far less often	24	13.0
Somewhat less often	17	9.2
About the same	87	47.0
Somewhat more often	44	23.8
Far more often	7	3.8
Missing	6	3.2

**Table 3.** How participants who needed health care services communicated with health care providers during COVID-19.

How do you communicate with your doctors/health care providers during the COVID-19 pandemic (check all that apply)?	<i>n</i>	%
Telephone	143	77.3
In person	71	38.4
Video-conference (e.g. ZOOM, SKYPE, WhatsApp?)	27	14.6
Email	26	14.1
TeleHealth/eHealth	24	13.0
Text	12	6.5
HealthLinkBC	11	5.9
Website	6	3.2
Social media (Facebook)	3	1.6
I have not communicated with doctors, health care providers or HealthLinkBC during the COVID-19 pandemic	16	8.6

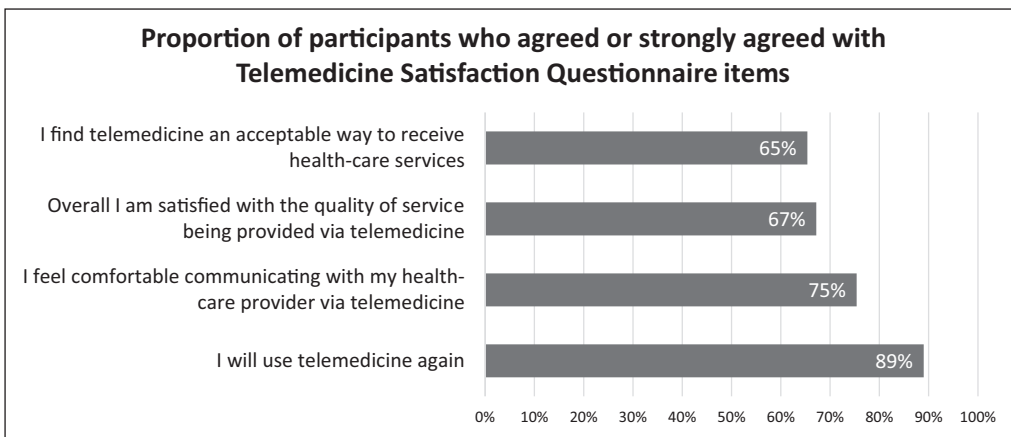
**Table 4.** Number of participants with access to services.

	Yes		No		Missing	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Telemedicine	189	67.7	25	9.0	65	23.3
Online mental health programs	105	37.6	51	18.3	123	44.1
Virtual or phone mental health services (i.e. connecting with someone)	132	47.3	40	14.3	107	38.4

There was no difference in total telemedicine satisfaction scores between men ( $M=3.79$ ) and women ( $M=3.90$ ),  $t(111)=0.51$ ,  $p=0.613$  and satisfaction was unrelated to age (Spearman's Rho  $r=-0.04$ ,  $p=0.71$ ). Satisfaction scores were higher for the 24 participants who had used video/video and phone ( $M=4.18$ ) compared to the 69 participants who used phone alone ( $M=3.79$ ),  $t(69) = 2.2$ ,  $p=0.031$ .

**Table 5.** Participant's self-reported frequency of health service use.

	<i>n</i>	%
Telemedicine		
Far less often	10	3.6
Somewhat less often	4	1.4
About the same	33	11.8
Somewhat more often	46	16.5
Far more often	39	14.0
Never/not applicable	137	49.1
Missing	10	3.6
Online mental health programs		
Far less often	5	1.8
Somewhat less often	4	1.4
About the same	21	7.5
Somewhat more often	7	2.5
Far more often	3	1.1
Never/not applicable	227	81.4
Missing	12	4.3
Virtual or phone mental health services (i.e. connecting with someone)		
Far less often	10	3.6
Somewhat less often	1	0.4
About the same	21	7.5
Somewhat more often	18	6.5
Far more often	16	5.7
Never/not applicable	204	73.1
Missing	9	3.2

**Figure 1.** Proportion of participants who agreed or strongly agreed to each of the Telemedicine Satisfaction Questionnaire items.

### *eHealth literacy and telemedicine satisfaction*

Overall, participants' eHealth literacy scores were relatively high (See Table 6). Age was unrelated to eHealth literacy ( $r=0.018$ ,  $p=0.779$ ). Women ( $M=30.9$ ) had higher eHealth literacy scores



**Table 6.** Participant responses to the 8-item eHEALS (eHealth literacy) scale.

	N	M	SD
I know what health resources are available on the Internet	264	3.69	0.96
I know where to find helpful health resources on the Internet	263	3.77	1.01
I know how to find helpful health resources on the Internet	264	3.87	0.93
I know how to use the Internet to answer my questions about health	262	3.94	0.88
I know how to use the health information I find on the Internet to help me	261	3.87	0.89
I have the skills I need to evaluate the health resources I find on the Internet	264	3.92	0.92
I can tell high quality health resources from low quality health resources on the Internet	264	3.78	0.99
I feel confident in using information from the Internet to make health decisions	263	3.51	1.01
Total eHealth literacy scale sum score	264	30.25	6.40

compared to men ( $M=28.4$ ),  $t(100.7)=2.53$ ,  $p=0.013$  (mean difference = 2.53, 95% bootstrapped CI .55, 4.41). eHealth literacy scores were higher among those who had used telemedicine ( $M=31.09$ ) compared to those who had not ( $M=29.53$ ), though this did not reach significance,  $t(259)=1.95$ ,  $p=0.052$ . Telemedicine satisfaction was positively correlated with total eHealth literacy scores (Spearman's Rho  $r=0.26$ ,  $p=0.005$ ).

### Telemedicine experiences and suggestions

Six themes were identified from the open-ended responses from 79 participants who shared their experiences and suggestions about telemedicine (see Table 7). Participants expressed preferences for seeing their own family doctor, using video over telephone, and some found telemedicine impersonal. In addition, participants suggested that telemedicine should supplement, not replace, in person visits, and that reliable internet access for rural residents was needed.

## Discussion

The purpose of this study was to understand how adult rural citizens were using health care services, specifically telemedicine, during the first 4 months of the COVID-19 pandemic and their overall satisfaction with these services. Two-thirds (66.3%) of participants indicated they needed health care during the pandemic. Although nearly half (47%) of participants had communicated with their physician/health care providers with about the same frequency during, as before, COVID-19, the 22% of participants that had communicated somewhat/far less during than before COVID-19 may be cause for concern. Whether this had consequences for participants is unknown, but evidence from a rural US survey suggested negative consequences when people were unable to get health care.<sup>28</sup> Open-ended responses (to a question about telemedicine experiences) suggested that in some cases participants had delayed accessing services - perceiving them to be either too risky or unavailable - and in other cases participants noted that their appointments and even surgeries had been cancelled to relieve pressure on the healthcare system. The effects of delayed care, whether patient or system initiated, cannot be underestimated. In some Canadian jurisdictions non-urgent procedures and elective surgeries have been postponed for months.<sup>29</sup> The extent and impact of delayed care in Canada is unknown owing to suboptimal health data infrastructure and reporting system for both managing the pandemic and for ensuring everyone's health-care needs are met.<sup>29</sup> Ensuring that people remain engaged in their health care with the shift to telemedicine is para-

**Table 7.** Participants open-ended responses to telemedicine experiences and suggestions.

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Please share your experience with telemedicine. Do you have any suggestions to improve telehealth services in rural communities?

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Telemedicine and fit/lack of fit of appointment types

“Physiotherapy by teleconference.”

“I had a telephone conversation with my Dr on 2 occasions, once to refill a RX and the other to talk about labs tests.”

“I feel it’s not a great way to diagnose a problem, depending on what it is. I also feel like they try to rush through them.”

“In an emergency, sure its a good tool, but not perfect.”

“Had two medical appointments cancelled. One was a surgical daycare procedure. First telemedicine appointment was thru our local hospital. It did save us a trip to [city name].”

Continuity of care

“Only if provided by my own family doctor.”

“Being able to see a doctor or find a family doctor is challenging.”

Telemedicine modality preferences

“My doctor just talks on the phone, but I would much rather use video conferencing software to take advantage of non-verbal cues, etc.”

“Our GP was not offering video appointments, only telephone. If video is added I would happily continue with telehealth.”

“Video works best but phone has been fine.”

Telemedicine as impersonal

“I find it is impersonal. I also found I have not seen the doctor for pressing issues (such as a lump in my breast) because I feel I won’t have access to a mammogram right now.

“Effective health service MUST be done person to person. Telehealth is great for check ins and med renewals but it is Not healing it is simply administration/management and serves the system. . .Not the people.”

Telemedicine: not a replacement for in-person visits is good for only some things

“Should not replace in person Dr. visits. I think having both options would be the best of both worlds but I would hate to see telehealth replace face to face visits; which I could see happening in rural areas.”

“It was ok to renew pills but doesn’t substitute for face to face visits.”

“We need to ensure that telemedicine is an addition and not a replacement for primary care.”

“I think it depends on what you are using it for. . . Some things make total sense to use telemedicine but for others an in-person visit is more useful.”

Suggestions for improving telemedicine

“Only use it for prescription renewals not patients with physical ailments.”

“Telehealth could be improved with basic knowledge as to reasons to see a doctor face to face and from a distance. More access to video conferencing.”

“Ensure all rural communities have reliable internet service.”

“At this point the internet and access to it should be considered a utility not a luxury.”

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mount. Findings from this study suggest that access to telemedicine, satisfaction with telemedicine, and e-health literacy may play important roles.

Although the majority of rural participants had access to telemedicine, under half (44%) had used it during the pandemic. This finding is comparable to a United States survey in which 46% of rural households reported using telemedicine for advice/treatment with their doctor or other health care professional by phone, smartphone, tablet, or computer.<sup>28</sup> That close to half of participants reported using telemedicine, may be linked to the older age range of the sample and the possibly of more with chronic conditions, as nearly 15% of participants rated their health as fair to poor. It

is well known that rural communities are home to a larger proportion of older adults. In the province where this study was conducted, 25%–50% of the rural populations are 55 years and older.<sup>30</sup>

In the current study, telephone was the most common mode of communication, followed by videoconference, texting, and email. Participants who reported using videoconference to connect with health care providers were more satisfied than those who used telephone alone. Open-ended responses were aligned with these quantitative results, with many participants preferring use of video but it was not always an option their physicians offered. Prior work has shown that the video component significantly contributes to quality and satisfaction of the visit.<sup>31</sup> In their retrospective cohort urban-based study, Ramaswamy et al.<sup>32</sup> reported significantly higher satisfaction scores for video visits than in-person visits during COVID-19. Often telephone is the only option in rural communities where the lack of high-speed broadband internet is a major barrier to the use of video-consultations, which have been found to be as effective as in-person care.<sup>33</sup>

All participants within the context of this Canadian study have access to free mental health services, which is consistent with their relatively high self-reported access to online mental health programs and virtual services. It is of concern that nearly one fifth of participants reported lack of access to virtual mental health services at a time when there has been a well-documented increase in the need for these services.<sup>34</sup> For rural participants it is quite likely they did not have access to minimum broadband speed; only 37% of rural households in the province where the study was conducted had access to the minimum broadband speed necessary to support high quality video conferencing or online learning in 2017.<sup>35</sup> Despite Provincial government commitment to a Digital Health Strategy and investment expanding high speed internet to more rural communities in recent years,<sup>36</sup> performance testing conducted by the Canadian Internet Registration Authority in July 2020 suggested that rural internet speeds have plateaued at 5.5 Mbps (compared to 51.5 Mbps in urban areas) since the start of the COVID-19 pandemic.<sup>17</sup> However, it is also possible participants lacked awareness of the mental health services available despite provincial and federal investments in mental health resources.<sup>34</sup> That between 38% and 44% left the access to mental health services questions blank could suggest a lack of knowledge about these services. These participants may also not have needed the services and therefore were not aware of them. The vast majority did not use the services but a sizeable number used them more during than before COVID-19 (3.6%–12.2%). This usage resonates with a national survey that found that 50% of Canadians reported worsening mental health since the pandemic with 10% reporting a worsening of their mental health by ‘a lot’ as a result of COVID-19.<sup>37</sup>

Rural participants in the current study had relatively high levels of satisfaction with telemedicine. Similarly, 88% of rural households in the United States reported wide satisfaction with telemedicine visits and the most recent advice or treatment they had received.<sup>28</sup> Similar to the current findings, Kruse et al.<sup>20</sup> identified the effectiveness and efficiency of telemedicine in contributing to patient satisfaction. However, a third of participants in the current study were not satisfied with the acceptability and quality of telemedicine care. Open-ended responses centered around ensuring telemedicine is a supplement, not replacement for, in-person care. The mixed findings reflect the need for providers to integrate telemedicine into their usual practices where appropriate while balancing the need to maintain the personal and human touch that study participants found challenging with telemedicine.

It is possible that individuals with higher eHealth literacy are more willing to use telemedicine. Our results suggest this pattern, with those having used telemedicine having higher levels of eHealth literacy, however, this did not reach significance. A unique and important finding from this study is the positive relationship between telemedicine satisfaction and e-health literacy. As COVID-19 has catapulted us into greater reliance on telemedicine, it is imperative that rural citizens possess the knowledge, comfort and abilities to find and use information and digital tools.

Indeed, the digital divide encompasses more than just access to broadband connectivity, but also the tools, ability, and willingness to engage with virtual solutions.<sup>38</sup> Building rural residents' capacity to understand and have personal and technical comfort with the receipt of health care through technology will need to involve telemedicine literacy training and support.<sup>38</sup>

### *Limitations and future research directions*

Responses were from participants who completed an online survey, excluding the perspectives of those without internet access or tools to access the internet (both hardware or ability). Telemedicine use may differ for those without access to broadband connection, which even for many who used the services was not stable and reliable. The survey was administered during the summer months when there was some respite from COVID-19.<sup>39</sup> The Provincial re-start plan (currently on pause with Province-wide restrictions in place) meant more people were returning to work, restrictions were being loosened, and provider practices opened for more in-person visits,<sup>40</sup> perhaps influencing responses. The primarily white, female, and well-educated sample with good to excellent self-reported health may not reflect the broader rural demographic. Thus, eHealth literacy scores may not generalize to other rural community members. Information about the satisfaction of those who did not access telemedicine was not obtained, limiting insights into unmet needs.

Future research could focus on the impact of the digital divide<sup>41,42</sup> on rural health equity during and after the COVID-19 pandemic. Survey participants were rural citizens in general but future research might target "at-risk" populations such as those with chronic diseases, mobility issues, mental health challenges, and substance use, known to be more prevalent in rural communities.<sup>43</sup> As COVID-19 has intensified mental health needs in general,<sup>37</sup> it would be valuable to explore rural residents need for these services relative to their knowledge of and access to services. This will allow researchers and health care providers to better understand the discrepancies between access and usage of telemedicine relative to population needs in rural settings. The importance of e-literacy to telemedicine satisfaction warrants further research, particularly interventions to train and build capacity especially for those where e-literacy is low.

### **Conclusion**

In conclusion, during the COVID-19 pandemic, two thirds of rural residents in a Canadian western province self-reported having a health care need, the majority had access to telemedicine, and just under half had used it. Compared to pre-COVID-19, self-reported telemedicine use had increased during COVID-19 as had use of mental health online programs and virtual services. E-Health literacy was positively associated with satisfaction with telemedicine. Yet, rural citizens also experienced challenges with telemedicine access due to unreliable/unstable internet and found the service impersonal. The lack of digital infrastructure is an ongoing concern for rural communities if they are to experience health care equity comparable to their urban counterparts. If telemedicine is to be incorporated into practice during and following COVID-19, it is important to ensure that rural residents have the support needed to engage with this form of remote care.

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## Notes

- i. Our definition of rural was based on Statistics Canada's "rural and small town" definition<sup>44</sup> which refers to being outside the commuting distance of centers with population of 10,000 or more; however, we increased this to 12,000 to be inclusive of target communities that have recently begun to slightly surpass 10,000, yet have previously been considered rural.
- ii. HealthLinkBC is a government-funded telehealth service that offers online self-assessment tool and resources for citizens in British Columbia during COVID-19. The platform also provides a 24-h hotline for COVID-19-related inquiries and emergency services.."]

## References

1. Subedi R, Greenberg TL and Roshanafshar S. Does geography matter in mortality? An analysis of potentially avoidable mortality by remoteness index in Canada. *Health Rep* 2019; 30(5): 3–15.
2. Orser BA and Wilson CR. Canada needs a national strategy for anesthesia services in rural and remote regions. *CMAJ* 2020; 192(30): E861–E863.
3. Nielsen M, D'Agostino D and Gregory P. Addressing rural health challenges head on. *Mo Med*. 2017; 114(5): 363–366.
4. World Health Organization. *Telemedicine opportunities and developments in member states: report on the second global survey on eHealth*. Geneva, Switzerland: World Health Organization Press; 2010.
5. Albahri OS, Albahri AS, Mohammed KI, et al. Systematic review of real-time remote health monitoring system in triage and priority-based sensor technology: taxonomy, open challenges, motivation and recommendations. *J Med Syst* 2018; 42(5): 80.
6. Benavides-Vaello S, Strode A and Sheeran BC. Using technology in the delivery of mental health and substance abuse treatment in rural communities: a review. *J Behav Health Serv Res*. 2013; 40(1): 111–120.
7. Miah SJ, Hasan J and Gammack JG. On-cloud healthcare clinic: an e-health consultancy approach for remote communities in a developing country. *Telematics Inf* 2017; 34(1): 311–322.
8. Bashshur RL, Shannon GW, Smith BR, et al. The empirical foundations of telemedicine interventions for chronic disease management. *Telemed J E Health* 2014; 20(9): 769–800.
9. Call VR, Erickson LD, Dailey NK, et al. Attitudes toward telemedicine in urban, rural, and highly rural communities. *Telemed J E Health* 2015; 21(8): 644–651.
10. Kaambwa B, Ratcliffe J, Shulver W, et al. Investigating the preferences of older people for telehealth as a new model of health care service delivery: a discrete choice experiment. *J Telemed Telecare* 2017; 23(2): 301–313.
11. Rush KL, Hatt L, Gorman N, et al. Planning telehealth for older adults with atrial fibrillation in rural communities: understanding stakeholder perspectives. *Clin Nurs Res* 2019; 28(2): 130–149.

12. Orlando JF, Beard M and Kumar S. Systematic review of patient and caregivers' satisfaction with telehealth videoconferencing as a mode of service delivery in managing patients' health. *PLoS One* 2019; 14(8): e0221848.
13. Harkey LC, Jung SM, Newton ER, et al. Patient satisfaction with telehealth in rural settings: a systematic review. *Int J Telerehab* 2020; 12(2): 53–64.
14. Khalid AF. How to build a better Canada after COVID-19: make telehealth the primary way we deliver health care, <https://theconversation.com/how-to-build-a-better-canada-after-covid-19-make-telehealth-the-primary-way-we-deliver-health-care-140702> (2020, accessed 22 December 2020).
15. Heath S. Patient satisfaction with telehealth high following COVID-19, <https://patientengagementhit.com/news/patient-satisfaction-with-telehealth-high-following-covid-19> (2020, accessed 22 December 2020).
16. Hirko KA, Kerver JM, Ford S, et al. Telehealth in response to the COVID-19 pandemic: implications for rural health disparities. *J Am Med Inform Assoc* 2020; 27(11): 1816–1818.
17. Canadian Internet Registration Authority. New internet performance data shows urban speeds improving while rural speeds plateau, <https://www.cira.ca/newsroom/state-internet/new-internet-performance-data-shows-urban-speeds-improving-while-rural> (2020, accessed 5 September 2020).
18. Norman CD and Skinner HA. eHEALS: the eHealth literacy scale. *J Med Internet Res* 2006; 8(4): e27.
19. Witten NA and Humphry J. The electronic health literacy and utilization of technology for health in a remote Hawaiian community: Lana'i. *Hawaii J Med Public Health* 2018; 77(3): 51–59.
20. Kruse CS, Karem P, Shifflett K, et al. Evaluating barriers to adopting telemedicine worldwide: a systematic review. *J Telemed Telecare* 2018; 24(1): 4–12.
21. Cheng C, Beauchamp A, Elsworth GR, et al. Applying the electronic health literacy lens: systematic review of electronic health interventions targeted at socially disadvantaged groups. *J Med Internet Res* 2020; 22(8): e18476.
22. Monaghesh E and Hajizadeh A. The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence. *BMC Public Health* 2020; 20(1): 1193.
23. Smith AC, Thomas E, Snoswell CL, et al. Telehealth for global emergencies: implications for coronavirus disease 2019 (COVID-19). *J Telemed Telecare* 2020; 26(5): 309–313.
24. Yip MP, Chang AM, Chan J, et al. Development of the Telemedicine Satisfaction Questionnaire to evaluate patient satisfaction with telemedicine: a preliminary study. *J Telemed Telecare* 2003; 9(1): 46–50.
25. Richtering SS, Morris R, Soh SE, et al. Examination of an eHealth literacy scale and a health literacy scale in a population with moderate to high cardiovascular risk: Rasch analyses. *PLoS One* 2017; 12(4): e0175372.
26. Cochran WG. The  $\chi^2$  test of goodness of fit. *Ann Math Stat* 1952; 23(3): 315–345.
27. Ross A and Willson VL. Independent samples *t*-test. In: Ross A and Willson VL (eds) *Basic and advanced statistical tests: writing results sections and creating tables and figures*. Rotterdam: SensePublishers, 2017, pp.13–16.
28. NRP-Harvard. Poll: 24% of households in rural America report being unable to get medical care for serious problems during the coronavirus outbreak, with 56% reporting harmful health consequences as a result, <https://www.hsph.harvard.edu/news/press-releases/poll-24-of-households-in-rural-america-report-being-unable-to-get-medical-care-for-serious-problems-during-the-coronavirus-outbreak-with-56-reporting-harmful-health-consequences-as-a-result/> (2020, accessed 22 December 2020).
29. Ammi M. Collateral damage: the unmet health-care needs of non-COVID-19 patients, <https://theconversation.com/collateral-damage-the-unmet-health-care-needs-of-non-covid-19-patients-145934> (2020, accessed 22 December 2020).
30. Southern Interior Beetle Action Coalition. Rural British Columbia aging populations and changing housing requirements (2015), <https://www.bcruralcentre.org/wp-content/uploads/2016/09/SIBAC-Rural-Aging-Housing-Phase-1-Final-Report-July-2015.pdf> (2020, accessed 22 December 2020).
31. McLendon SF. Interactive video telehealth models to improve access to diabetes specialty care and education in the rural setting: a systematic review. *Diabetes Spectr* 2017; 30(2): 124–136.

32. Ramaswamy A, Yu M, Drangsholt S, et al. Patient satisfaction with telemedicine during the COVID-19 pandemic: retrospective cohort study. *J Med Internet Res* 2020; 22(9): e20786.
33. Greenhalgh T, Wherton J, Shaw S, et al. Video consultations for covid-19. *BMJ* 2020; 368: m998.
34. Centre for Addiction and Mental Health. Mental health in Canada: Covid-19 and beyond CAMH Policy Advice (2020), <http://www.camh.ca/-/media/files/pdfs---public-policy-submissions/covid-and-mh-policy-paper-pdf.pdf> (2020, accessed 22 December 2020)
35. Innovation, Science and Economic Development Canada. High-speed access for all: Canada's connectivity strategy, [https://www.ic.gc.ca/eic/site/139.nsf/eng/h\\_00002.html](https://www.ic.gc.ca/eic/site/139.nsf/eng/h_00002.html) (2019, accessed 22 December 2020).
36. Barclay C and Wright M. British Columbia digital health strategy, [https://www.bchimps.org/resources/Documents/2019%20Spring%20Conference/HLTH%20ADMs\\_Barclay\\_Wright\\_1Mar2019.pdf](https://www.bchimps.org/resources/Documents/2019%20Spring%20Conference/HLTH%20ADMs_Barclay_Wright_1Mar2019.pdf) (2019, accessed 16 April 2020).
37. Angus Reid Institute. Worry, gratitude & boredom: as COVID-19 affects mental, financial health, who fares better; who is worse? <https://angusreid.org/covid19-mental-health/> (2020, accessed 22 December 2020).
38. Gray DM, Joseph JJ and Olayiwola JN. Strategies for digital care of vulnerable patients in a COVID-19 world—Keeping in touch, <https://jamanetwork.com/channels/health-forum/fullarticle/2767347> (2020, accessed 22 December 2020).
39. AJMC Staff. A timeline of COVID-19 developments in 2020, <https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020> (2020, accessed 22 December 2020).
40. Province of British Columbia. BC's restart plan: next steps to move BC through the pandemic, [https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/gdx/bcs\\_restart\\_plan\\_web.pdf](https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/gdx/bcs_restart_plan_web.pdf) (2020, accessed 22 December 2020).
41. Cortelyou-Ward K, Atkins DN, Noblin A, et al. Navigating the digital divide: barriers to telehealth in rural areas. *J Health Care Poor Underserved* 2020; 31(4): 1546–1556.
42. Nagata JM. Rapid scale-up of telehealth during the COVID-19 pandemic and implications for subspecialty care in rural areas. *J Rural Health* 2021; 37(1): 145.
43. Roberts KC, Rao DP, Bennett TL, et al. Prevalence and patterns of chronic disease multimorbidity and associated determinants in Canada. *Health Promot Chronic Dis Prev Can* 2015; 35(6): 87–94.
44. du Plessis V, Beshiri R and Bollma RD. *Definitions of rural: research paper*. Ottawa, ON: Statistics Canada, 2002.