



Telemedicine Management of COPD: A Brief Review of Advancements in Chronic Disease Treatment and Implications for Medical Education

Mario Corrado¹, Shaun Andrew Hanycz¹

¹University of Ottawa, Ottawa, Ontario, Canada

Date Submitted: July 10, 2022

Date Accepted: November 28, 2022

Date Published: June 30, 2023

DOI: <https://doi.org/10.18192/UOJM.v13i01.6463>

Keywords: *Telemedicine, COPD, Curriculum*

ABSTRACT

Social determinants of health are non-medical, social and economic factors that influence health. The practice of telemedicine enables physicians to virtually connect patients with healthcare resources. Throughout the COVID-19 pandemic, healthcare providers have increasingly utilized telemedicine as a method to provide appropriate care to patients with chronic diseases, including Chronic Obstructive Pulmonary Disease (COPD); a progressive obstructive lung disorder, substantially impacted by social determinants of health including access to healthcare. The successful utilization of telemedicine in the care of patients with chronic diseases, including COPD, highlights its emerging importance in healthcare. However, there is a paucity of published telemedicine curricula by Canadian medical schools, and Canadian student preparedness for virtual healthcare delivery remains unknown, although medical students in other countries report feeling inadequately prepared. Here, we provide a brief review of the utilization of telemedicine in COPD management and advocate for the rapid introduction of a formalized telemedicine curriculum at the undergraduate and postgraduate levels to improve access to care.

RÉSUMÉ

Les déterminants sociaux de la santé sont des facteurs non médicaux, sociaux et économiques qui influencent la santé. La pratique de la télémédecine permet aux médecins de mettre virtuellement les patients en contact avec les ressources de santé. Tout au long de la pandémie de COVID-19, les prestataires de soins de santé ont de plus en plus utilisé la télémédecine comme méthode pour fournir des soins appropriés aux patients atteints de maladies chroniques, notamment la Maladie Pulmonaire Obstructive Chronique (MPOC), un trouble pulmonaire obstructif progressif, fortement influencé par les déterminants sociaux de la santé, y compris l'accès aux soins de santé. L'utilisation réussie de la télémédecine dans les soins aux patients atteints de maladies chroniques, y compris la MPOC, met en évidence son importance émergente dans les soins de santé. Cependant, les écoles de médecine canadiennes ont peu publié de programmes d'études sur la télémédecine, et la préparation des étudiants canadiens à la prestation de soins de santé virtuels reste inconnue, bien que les étudiants en médecine d'autres pays déclarent se sentir mal préparés. Nous présentons ici une brève revue de l'utilisation de la télémédecine dans la gestion de la MPOC et prôtons l'introduction rapide d'un programme formel de télémédecine au niveau du premier cycle et du troisième cycle afin d'améliorer l'accès aux soins.

Telemedicine use in rural settings and the influence of COVID-19

The Canada Health Act aims to provide equal access to care to all Canadians without barriers.¹ Despite this aim, Social Determinants of Health (SDH), including economic stability, education and access to healthcare, continue to act as a barrier against the provision of equitable healthcare services in Canada. Rural-dwelling patients are particularly disadvantaged.²⁻⁴ Decreased proximity to resources and physicians are associated with worse outcomes for patients living rurally.²⁻⁴ The COVID-19 pandemic has further disadvantaged rural living patients by restricting in-person access to an already-limited pool of healthcare services.⁵ However, the COVID-19 pandemic accelerated the implementation of alternate healthcare delivery options for urban and rural households, including telemedicine.

Telemedicine is the practice of remote clinical encounters that enable real-time communication between a patient and a healthcare provider.⁶ Telehealth is an umbrella term that encompasses the various virtual means to access healthcare services, including telephone and videoconferencing.⁶ A 154% increase in videoconferencing as a means to provide telemedicine occurred between January 2020 and the onset of the COVID-19 pandemic in March 2020.⁷ Throughout the pandemic, patients and providers have consistently responded favourably to the utilization of telemedicine (Table 1). A 2020 poll of 1800 Canadian residents by the Canadian Medical Association found that Canadian patients reported being satisfied overall (90-92%) when they connected with their physician by video (90%), by phone (91%) or with a virtual health provider (92%), compared to a 98% satisfaction rate for in-person appointments with their physician.⁸ 38% of respondents were in favor of virtual appointments as the first point of contact with their physician.⁸ In 2021, 94% of Canadian physicians reported using virtual care, and 71% were satisfied with telephone encounters.⁹ Collectively, 64% of Canadian physicians are planning to maintain or increase their use of telemedicine within their post-pandemic practice, and patients are satisfied with this implementation.⁹ The ubiquitous application in response to COVID-19 and continued utilization has opened the discussion on the role of telemedicine post-pandemic to service patients in urban and rural centers.

Chronic diseases are particularly impacted by reduced

access to care.²⁻⁴ and are well-positioned to benefit from improved virtual care platforms. Chronic Obstructive Pulmonary Disease (COPD) serves as an ideal model to highlight the benefit of continued telemedicine use in rural chronic disease management post-pandemic due to elevated exacerbation risk in rural areas and the large number of healthcare resources required for management.^{4,12}

COPD as a model of the benefits of telemedicine

COPD is a progressive obstructive lung condition resulting from the interaction between genetic and environmental factors, predominantly tobacco smoking. In 2008, COPD affected more than 700 000 patients in Ontario over the age of 35, accounting for 24% of hospital admissions and 24% of emergency room visits.¹⁰ COPD disproportionately affects patients living in rural areas.⁴ SDH, including housing insecurity, food insecurity, and difficulty obtaining transport to appointments are instrumental yet overlooked factors in the management of COPD.¹⁰ Burkes et al., 2018 identified living in a rural area as an independent risk factor for the development of COPD and also increases the likelihood of an acute exacerbation by 70%.¹² Comparative morbidity and mortality figures for patients with COPD in Ontario are elevated in northern and agricultural regions compared to urban areas, mirroring a relative reduction in physician and healthcare resources.⁴ 19.4% of patients in Ontario who are admitted for COPD will be re-admitted within thirty days of discharge.¹³ The overwhelming number of hospital readmissions in COPD patients, substantial economic burden, reduced access to health care in a rural setting, and the COVID-19 pandemic highlights an opportunity for increased utilization of telemedicine in the management of COPD.

The COVID-19 pandemic has resulted in a monumental shift toward virtual healthcare. Healthcare providers have been encouraged to provide virtual care to outpatients in an outpatient clinical setting to reduce the spread of infection among patients and providers. Despite increased susceptibility to COVID-19 sequelae, hospitalizations due to COPD exacerbations have decreased by 27% to 78% in Spain, Germany, the UK and China during the pandemic compared to pre-pandemic.¹⁴ The precise contributors of hospitalization reduction are unknown but likely involve a combination of pandemic-specific efforts to improve infection control measures (social distancing and hand washing) and increased access to healthcare

via telehealth.¹⁵ Mohammed et al., 2021 demonstrated that 96.6% of primary care providers in southwestern Ontario were offering telemedicine within their clinic, and 66.4% of visits were virtual compared to 6.5% pre-pandemic.¹⁶

Telemedicine has been shown to be an effective tool against COPD sequelae. A recent systematic review found that the implementation of telemedicine strategies reduces emergency room visits, acute exacerbation-related readmissions and overall mortality.¹⁷ COPD providers have reported that telemedicine can be used to provide high-quality education and anticipatory guidance and provide high-quality care for all aspects of COPD management.¹³ Providers have identified increased patient attendance, acceleration of workflows and increased free time as benefits of virtual appointments.¹⁵ Importantly, 91% of providers report that they plan to continue to offer telehealth services post-pandemic.¹⁸ Patients identified an appreciation for the increased clinician-patient engagement and decreased costs (i.e., on-site patient parking costs, fuel costs) that occur with telehealth. Further utilization of telemedicine by COPD providers and patients would help to minimize COPD exacerbations in rural populations and therefore reduce hospitalizations and associated economic burdens. However, access to high-quality internet is required for a seamless telemedicine encounter and is known to differ based on age, sex, ethnicity, education, and income.¹⁹ This poses a potential barrier in COPD management that must be addressed in a future medical system that relies on virtual appointments.

Current short- and long-term Canadian COPD guidelines include a combination of education, pharmacotherapy and rehabilitation.²⁰ Bronchodilators such as beta2-agonists and antimuscarinics are utilized to reduce the frequency and severity of symptoms, reduce exacerbations and improve exercise tolerance.²⁰ However, incorrect inhaler technique may diminish their effectiveness in COPD patients. Additional long-term management strategies include pneumococcal and influenza vaccinations, pulmonary rehabilitation and home oxygen therapy when indicated.²⁰ Decreased proximity to medical care in rural settings limits the utility of pulmonary rehabilitation and access to medication.²⁻⁴ Telemedicine provides an alternate avenue towards ensuring optimal patient care in rural settings by enabling high-quality COPD management from a distance. A recent clinical trial comparing conventional in-person follow-up to telemedicine follow-up found that

there was no significant difference in time until the first exacerbation and in the number of exacerbations between the two groups.²¹ Telemedicine implementation therefore enables healthcare providers to provide consistent patient education, symptom assessment, the opportunity to modify treatment accordingly, and access to specialists distant from rural centers.

The success of currently recommended COPD treatment protocols is dependent on patients' ability to access healthcare and the financial resources to access therapy. Patients are known to struggle with self-management following diagnosis secondary to SDHs, leading to increased re-admissions.¹⁰ This is particularly true in rural areas, where access to a holistic COPD management team is difficult. Telemedicine is a sustainable solution to mitigate poor outcomes experienced by patients with decreased access to healthcare. Patients and providers have both reported high rates of satisfaction with telemedicine, and providers have expressed interest in continuing virtual consultations post-pandemic. Additionally, there is evidence to suggest that COPD management via virtual means has similar outcomes as its in-person counterpart. For example, the effectiveness of inhaler education among asthma and COPD patients was found to be similar irrespective of delivery method (in-person or virtually).²² The emergence of telehealth to provide high-quality, sustainable medical management to patients with COPD will continue to be an essential tool in the management of rural-based patients with chronic diseases.

Telemedicine instruction in undergraduate medical education

As virtual care modalities become increasingly implemented into modern healthcare, it is essential that medical students are trained to leverage such technology effectively.²³ Undergraduate medical education represents an invaluable window of opportunity to lay the foundations of virtual care delivery for future physicians.²³ To date, only seven peer-reviewed studies have been published on undergraduate telemedicine curricula, including four in the USA, two in Australia and one in Switzerland.²⁴ More recently, the University of Ottawa has published a list of formal learning objectives to be implemented into its growing telemedicine curriculum.²⁵ There remains, however, a scarcity of peer-reviewed studies of telemedicine curricula in Canadian medical schools. Comparatively,

The Society of Teachers of Family Medicine (STFM) in the USA formed a task force at the onset of the COVID-19 pandemic to formally develop a national telemedicine program for family medicine residents and practitioners.²⁶ Medical students report feeling unprepared to effectively employ telemedicine upon graduation,²⁷ and 88% of medical students in one study agreed that telemedicine is an important educational tool that would be highly relevant in their future practice.²⁸ It is of vital importance that telemedicine education be formalized in order to properly meet the post-pandemic preferences of the Canadian population. Curricula coordinators can refer to previously published telemedicine programs,^{24, 25} to guide initial curriculum development.

Medical trainee programs may leverage existing practice and assessment methods to implement core concepts of telemedicine. Many physicians have and will continue to adopt telemedicine into their practice. Trainees must be encouraged to practice telemedicine while working with preceptors who can provide foundational skills for a future career that may utilize telehealth technology. Medical education programs may distribute existing telemedicine videos, journal articles and supplementary resources to their trainees or develop their learning material tailored to their curriculum. Additionally, Objective Structured Clinical Examinations (OSCEs), which have been used by medical schools worldwide for decades to assess clinical skills, can be adapted to formally evaluate a trainee's performance during a standardized telemedicine encounter.

Conclusion

The COVID-19 pandemic has increased the availability and recognition of telemedicine as an option to provide high-quality medical care. Widespread implementation of telehealth modalities in addition to in-person visits seeks to minimize healthcare disparities between rural and urban-based patients. Reduced disparities in access to care has the potential to improve patient outcomes in long-term chronic disease management. Medical schools and residency programs have an obligation to integrate telemedicine into their curricula in an effort to better prepare trainees for the future of healthcare.

Table 1. Telemedicine perceptions among Canadian physicians and patients during the COVID-19 pandemic. Adapted from references.^{8,9}

% of patients who reported being satisfied overall with a phone appointment with their doctor	91
% of patients in favor of having first appointment with physician in virtual setting (phone, video, email, text) rather than an in-person appointment	38
% of physicians who report use of virtual care in their practice	94
% of physicians who reported being satisfied overall with telephone appointments	71

REFERENCES

1. Canada Health Act, RSC 1985, c C-6, retrieved on 2022-04-28.
2. Wilson CR, Rourke J, Oandasan IF, Bosco C; On behalf of the Rural Road Map Implementation Committee; Au nom du Comité sur la mise en œuvre du Plan d'action sur la médecine rurale. Progress made on access to rural health care in Canada. *Can Fam Physician*. 2020 Jan;66(1):31–6.
3. Subedi R, Greenberg TL, Roshanafshar S. Does geography matter in mortality? An analysis of potentially avoidable mortality by remoteness index in Canada. *Health Rep*. 2019 May 15;30(5):3-15.
4. Crighton EJ, Ragetlie R, Luo J, To T, Gershon A. A spatial analysis of COPD prevalence, incidence, mortality and health service use in Ontario. *Health Rep*. 2015 Mar;26(3):10–8.
5. Mueller JT, McConnell K, Burow PB, Pofahl K, Merdjanoff AA, Farrell J. Impacts of the COVID-19 pandemic on rural America. *Proc Natl Acad Sci USA*. 2021 Jan 5;118(1):2019378118
6. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: a systematic review of reviews. *Int J Med Inform*. 2010 Nov;79(11):736–71.
7. Koonin LM, Hoots B, Tsang CA, Leroy Z, Farris K, Jolly T, et al. Trends in the Use of Telehealth During the Emergence of the COVID-19 Pandemic – United States, January–March 2020. *MMWR Morb Mortal Wkly Rep*. 2020 Oct 30;69(43):1595–9.
8. Canadian Medical Association. What Canadians think about virtual health care [Internet]. 2020 [cited 2022 Jun 4]. Available from: <https://www.cma.ca/sites/default/files/pdf/virtual-care/cma-virtual-care-public-poll-june-2020-e.pdf>
9. Canadian Medical Association. 2021 National Survey of Canadian Physicians. 2021 Aug. Report No.: <https://www.infoway-inforoute.ca/en/component/edocman/3935-2021-national-survey-of-canadian-physicians/view-document?Itemid=0>.
10. Kearney, L., Wiener, R.S., Dahodwala, M. et al. A mixed methods study to inform and evaluate a longitudinal nurse practitioner/community health worker intervention to address social determinants of health and chronic obstructive pulmonary disease self-management. *BMC Pulm Med* 2022. 22, 74.
11. Gershon AS, Guan J, Victor JC, Goldstein R, To T. Quantifying health services use for chronic obstructive pulmonary disease. *Am J Respir Crit Care Med*. 2013 Mar 15;187(6):596–601.
12. Burkes RM, Gassett AJ, Ceppe AS, Anderson W, O'Neal WK, Woodruff PG, et al. Rural Residence and Chronic Obstructive Pulmonary Disease Exacerbations. Analysis of the SPIROMICS Cohort. *Ann Am Thorac Soc*. 2018 Jul;15(7):808–16.
13. Gershon AS, Thiruchelvam D, Aaron S, Stanbrook M, Vozoris N, Tan WC, Cho E, To T. Socioeconomic status (SES) and 30-day hospital readmissions for chronic obstructive pulmonary (COPD) disease: A population-based cohort study. *PLoS One*. 2019 May 21;14(5):e0216741.
14. Alqahtani JS, Oyelade T, Aldhahir AM, et al.: Reduction in hospitalised COPD exacerbations during COVID-19: A systematic review and meta-analysis. *PLoS One* 2021; 16:e0255659.
15. Sculley JA, Musick H, Krishnan JA. Telehealth in chronic obstructive pulmonary disease: before, during, and after the coronavirus disease 2019 pandemic. *Curr Opin Pulm Med*. 2022 Mar 1;28(2):93–8.
16. Mohammed HT, Hyseni L, Bui V, Gerritsen B, Fuller K, Sung J, et al. Exploring the use and challenges of implementing virtual visits during COVID-19 in primary care and lessons for sustained use. *PLoS One*. 2021 Jun 24;16(6):e0253665.
17. Lu J-W, Wang Y, Sun Y, et al.: Effectiveness of Telemonitoring for Reducing Exacerbation Occurrence in COPD Patients With Past Exacerbation History: A Systematic Review and Meta-Analysis. *Front Med* 2021; 8:720019.
18. Miner H, Fatehi A, Ring D, Reichenberg JS. Clinician Telemedicine Perceptions During the COVID-19 Pandemic. *Telemed J E Health*. 2021 May;27(5):508–12.
19. Greenberg-Worisek AJ, Kurani S, Finney Rutten LJ, Blake KD, Moser RP, Hesse BW. Tracking Healthy People 2020 Internet, Broadband, and Mobile Device Access Goals: An Update Using Data From the Health Information National Trends Survey. *J Med Internet Res*. 2019 Jun 24;21(6):e13300.
20. Global Initiative for Chronic Obstructive Lung Disease. GOLD Pocket Guide 2019. 1–49 (2019).
21. Mínguez Clemente P, Pascual-Carrasco M, Mata Hernández C, Malo de Molina R, Arvelo LA, Cadavid B, et al. Follow-up with Telemedicine in Early Discharge for COPD Exacerbations: Randomized Clinical Trial (TELEMEDCOPD-Trial). *COPD: Journal of Chronic Obstructive Pulmonary Disease*. 2021 Jan 2;18(1):62–9.
22. Press VG, Arora N, Kelly CA, Carey KA, White SR, Wan W. Effectiveness of Virtual vs In-Person Inhaler Education for Hospitalized Patients With Obstructive Lung Disease: A Randomized Clinical Trial. *JAMA Netw Open*. 2020 Jan 3;3(1):e1918205.
23. Waseh S, Dicker AP: Telemedicine Training in Undergraduate Medical Education: Mixed-Methods Review. *JMIR Med Educ* 2019; 5:e12515.
24. Budakoğlu M, İrem I, Sayılır MU, Kıyak YS, Coşkun O, and Kula S. Telemedicine Curriculum in Undergraduate Medical Education : A Systematic Search and Review. *Health and Technology*. 2021. 11 (4) : 773–81.
25. Anawati M: Virtual Care in Undergraduate Medical Education: perspectives beyond the pandemic. How medical education can support a change of culture towards virtual care delivery in Canada. *Can Med Educ J* 2022; 13:92–98.
26. Theobald M, Brazelton T: STFM forms task force to develop a national telemedicine curriculum, from STFM. *Ann Fam Med Annals of Family Medicine*, 2020; 18:285–286.
27. Lehrer, Murray, Adler, Haerter. Telemedicine education for undergraduate medical students. Meeting of Keck School of Medicine of the University of Southern California. 2016; Los Angeles, CA
28. Boyers LN, Schultz A, Baceviciene R, Blaney S, Marvi N, Dellavalle RP, Dunnick CA. Tele dermatology as an educational tool for teaching dermatology to residents and medical students. *Telemed J E Health*. 2015 Apr;21(4):312-4.