



Original Article

Cardiac Rehabilitation in Canada During COVID-19

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ABSTRACT

Background: Cardiac rehabilitation programs (CRPs) had to change quickly in response to a shift in clinical priorities related to the coronavirus disease 2019 (COVID-19). Yet, no study has examined the effect of COVID-19 on CRPs and if there has been an adequate transition to alternative programming.

Methods: To examine the status of CRPs during the COVID-19 pandemic, a web-based questionnaire was completed by CRP managers from April 23rd to May 14th, 2020.

Results: Overall, 114 representatives of 144 CRPs (79.1% of Canadian programs) responded. Of respondents, 41.2% (n = 47) reported CRP closure; primary reasons were staff redeployment and facility closure (41% of 51 responses, for both). Redeployment occurred in open CRPs and closed CRPs (30% ± 34% and 47% ± 38% of employees, respectively; $P = 0.05$) and reduced hours in 17.8% ± 31% and 22.5% ± 33% for remaining employees; $P = 0.56$. Of open CRPs, 84.8% accepted referrals for medically high-risk patients pre-COVID-19; this level fell to only 43.5% during the COVID-19 pandemic, $P <$

RÉSUMÉ

Contexte : Les programmes de réadaptation cardiaques (PRC) ont dû s'adapter rapidement en réponse à un changement des priorités cliniques liées à la maladie à coronavirus 2019 (COVID-19). Pourtant, aucune étude n'a examiné l'effet du COVID-19 sur les PRC et s'il y a eu une transition adéquate vers une programmation alternative.

Méthodes : Pour examiner l'état des PRC durant la pandémie de COVID-19, un questionnaire en ligne a été rempli par les responsables des PRC du 23 avril au 14 mai 2020.

Résultats : Au total, 114 représentants de 144 PRC (79,1 % des programmes canadiens) y ont répondu. Parmi les répondants, 41,2 % (n = 47) ont signalé une fermeture du PRC; les principales raisons résidaient en un redéploiement du personnel ou une fermeture des installations (41 % des 51 réponses, avec une combinaison des deux). Le redéploiement a eu lieu pour les PRC ouverts et les PRC fermés (concernant 30 % ± 34 % et 47 % ± 38 % des employés, respectivement; $P = 0,05$) et les heures réduites pour 17,8 % ± 31 % et 22,5 % ± 33 % des employés restants; $P = 0,56$. Concernant les PRC

Cardiac rehabilitation programs (CRPs) provide aerobic and resistance training interventions, as well as delivery of risk-factor modification, nutrition, and psychosocial counselling and education. CRPs are effective in reducing morbidity, mortality, and hospital readmissions in patients with cardiovascular disease.¹ On March 11th, 2020, the World Health Organization declared the coronavirus

disease 2019 (COVID-19) a pandemic. The proportion of CRPs that closed in Canada or transitioned from group-based face-to-face models of care to alternative remote cardiac rehabilitation delivery strategies during the pandemic is not known.

An understanding of the state of CRPs, as well as rehabilitation delivery barriers and facilitators is important given that these services are likely to be in higher demand in subsequent phases of the pandemic. Indeed, there are reports of a reduction or delay in people seeking medical help for acute coronary syndromes and worsening heart failure symptoms, and preliminary reports of cardiac involvement during hospitalization for COVID-19.²⁻⁸ Given the mitigating effect of CR on emergency room visits, hospital admissions, and adverse patient outcomes, access and timely referral to CRPs should be a priority.^{1,9,10} In addition, it would be prudent for CRPs to be

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Ethics Statement: The research reported has adhered to the relevant ethical guidelines.

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See page 157 for disclosure information.

0.001. There was a significant reduction in patients with cognitive/communication/mobility deficits who were eligible to participate during the COVID-19 pandemic. Of respondents, 57%–82.6% reported safety concerns related to prescribing exercise to medically high-risk and vulnerable populations. CRPs transitioned from group-based to one-to-one delivery models—>80% by phone and/or e-mail. Any tele-rehabilitation (one-to-one/group) was also used by 32.7% and 43.5% of CRPs to deliver exercise and education, respectively (mostly one-to-one). Resource barriers cited by open and closed CRPs were related to technology—no tele-rehabilitation, lack of equipment and patient access (35% of all barriers)—and 25.3% of barriers were owing to greater demands on staff time.

Conclusions: Within 2-months of COVID-19 being declared a pandemic, 41.2% of CRPs were closed and almost half of employees redeployed. Less time-efficient one-to-one models of remote care, mostly by phone/e-mail, were adopted. Vulnerable populations were disproportionately affected, becoming ineligible owing to safety concerns. Strategies to open closed CRPs, admission of high-risk/vulnerable populations, and offering of group-based tele-rehabilitation should be a national priority.

prepared to accommodate a greater number of people as well as medically higher-risk patients in a setting of limited to no face-to-face contact.

Therefore, we examined the effect of COVID-19 on program closure, changes in the service delivery model, patient eligibility, and delivery barriers and facilitators in a pan-Canadian cross-sectional questionnaire-based study.

Materials and Methods

Study design

A web-based questionnaire was administered to Canadian CRPs from April 23rd to May 14th, 2020. CRPs were eligible if they offered a structured exercise component, and at least one other strategy to control cardiovascular risk factors pre-COVID-19. CRP managers were invited to participate via an e-mail with a hyperlink to the questionnaire. A reminder was sent 1 week later. For Quebec respondents, invitations/reminders were translated into French. Requirement of approval from the Ethics Review Board of the University Health Network was waived.

Questionnaire design

See the *Questionnaire Design* section of the [Supplemental Text](#). for a full description of the questionnaire. For the section on Ascertaining Barriers and Facilitators, there were questions related to prompted and unprompted perceived or actual facilitators, as well as barriers to CRP delivery before

restés ouverts, 84,8 % acceptaient de guider les patients à haut risque médical avant la COVID-19; ce niveau est tombé à seulement 43,5 % pendant la pandémie de COVID-19, $P < 0,001$. Parmi les patients dont la participation était éligible durant la pandémie de COVID-19, il y a eu une réduction significative du nombre de patients présentant des déficits cognitifs/communicationnels/de mobilité. Parmi les responsables interrogés, 57 % à 82,6 % ont fait état de problèmes de sécurité lorsqu'il était question de prescription d'exercice physique à des populations vulnérables et médicalement à haut risque. Les PRC sont passées d'un modèle de groupe à un modèle de prestation individuelle—>80 % par téléphone et/ou par courriel. La réadaptation à distance (individuelle/en groupe) a également été utilisée par, respectivement, 32,7 % et 43,5 % des PRC pour dispenser des exercices et des formations (principalement en séance individuelle). Les obstacles en matière de ressources identifiés par les PRC ouverts et fermés étaient liés à la technologie - pas de réadaptation à distance, manque d'équipement et de moyen d'accès par les patients (35 % de tous les obstacles) - et 25,3 % des obstacles étaient dus à des exigences plus importantes en matière de temps de travail du personnel. **Conclusions :** Dans les deux mois suivant la déclaration de la COVID-19 en tant que pandémie, 41,2 % des PRC ont été fermés et près de la moitié des employés ont été redéployés. Des modèles de soins individuels à distance, moins efficaces en termes de temps, principalement par téléphone/courriel, ont été adoptés. Les populations vulnérables ont été touchées de manière disproportionnée, devenant inéligibles pour des raisons de sécurité. Des stratégies d'ouverture des PRC fermés, d'admission des populations à haut risque ou vulnérables et d'offre de réadaptation à distance, en groupe, devraient constituer une priorité nationale.

and during the COVID-19 pandemic. For the section on Prompted Barriers and Facilitators, a 5-point Likert scale was used for CRP representatives to assess the significance, if any, of 11 listed facilitators, and 8 to 15 listed barriers for each of 4 categories: resources, exercise delivery, exercise prescription and risk-factor modification, and education delivery. These are presented in [Tables 1](#) and [2](#). For the section on Unprompted Barriers and Facilitators, respondents were also questioned as to what the single most important barrier was for each of these categories (referred to as unprompted barriers) and facilitators. These are presented in [Supplemental Figure S1](#).

Statistical analysis

Differences between subgroups were assessed using χ^2 or Fisher's exact tests for categorical variables. The Mann-Whitney U test was used for 2 independent samples when the continuous variable was not normally distributed. McNemar's test was used for paired nominal data.

Results

Response rate and descriptive characteristics

Of 180 questionnaires sent, 114 representatives of 144 CRPs completed the survey from April 23 to May 14th. Ten CRP managers represented 3 to 12 separate CRPs, and data were reported by respondent. CRPs are available in 10 of Canada's 13 provinces and territories, with no programs in the

Table 1. Actual and perceived barriers to continuing cardiac rehabilitation (CR) programs before and during the coronavirus disease 2019 (COVID-19) by open and closed programs

Barriers	Most-cited significant barriers during COVID-19				Most-cited significant barriers before COVID-19			
	CR (%)	Rank	No CR (%)	Rank	CR (%)	Rank	No CR (%)	Rank
Exercise Rx to people with cognitive impairment	82.6	1	65.2	2	10.4	2	10.3	3
Patients with MSK issues that require stationary aerobic training equipment do not have access	79.6	2	44	9	4	5	6.7	6
Exercise Rx to patients at high risk for medical complications	75.5	3	68.2	1	2	8	7.1	5
Assessment of mobility and balance	69.1	4	56.7	5	0	11	0	8
Assessment of cardiorespiratory or functional fitness	63.6	5	60	4	3.6	7	0	8
Exercise Rx to people with mobility and balance deficits	60.8	6	45.8	8	0	11	0	8
Exercise Rx to lower-functioning/frail patients	58	7	62.5	3	2	8	3.3	7
Exercise Rx to people with a language barrier	56.8	8	54.2	6	2	8	6.7	6
Patient difficulty using technology (education and RF modification)	49	9	44	9	9.6	3	10.3	3
Patients lack access to aerobic training equipment such as a stationary cycle	49	9	40	10	1.9	9	0	8
Patient anxiety and stress (delivery of exercise programming)	48.1	10	50	7	1.5	10	0	8
Patient access to technology (education and RF modification)	46.9	11	44	9	3.8	6	10.3	3
Patient access to technology (delivery of exercise programming)	44.4	12	38.5	11	11.1	1	16.7	2
Patient difficulty using technology (delivery of exercise programming)	42.6	13	33.3	13	9.3	4	9.4	4
Patients do not have access to resistance training equipment (eg, dumbbells/bands)	42	14	44	9	0	11	0	8
Remote access to hospital servers (delivery of exercise programming)	41.7	15	37.5	12	10.4	2	25	1

MSK, musculoskeletal; RF, risk factor; Rx, prescription.

Programs that responded as "I don't know" when prompted to rate barriers are not included in the denominator.

North,¹¹ and surveys were completed by CRP representatives from all 10 provinces (100%). It is reported that there are 182 CRPs in Canada¹²; thus, our study sample represents 79.1% of all programs. Most of the responding programs were located in Ontario (44.7%), were in urban areas (42.7%), were hospital-based/affiliated (40.5%), received funding from the hospital or clinical center (47.3%), enrolled ≥ 101 patients annually pre-COVID-19 (60.6%), and were mainly at capacity (62.2%). [Supplemental Tables S1](#) and [S2](#) show CRP characteristics.

Closed CRPs

Of 114 respondents, 41.2% reported that CR programming was discontinued during the pandemic from March 10th to April 5th, 2020. Of closed CRPs, 55% (n = 22 of 40) reported that they were planning on recommencing in the near future (during-COVID-19), with 31.8% (n = 7 of 22) using tele-rehabilitation, 13.6% using phone-based rehabilitation (n = 3 of 22), and 54.5% using other methods (n = 12 of 22) including online web resources, e-mailing of forms or resources, posting of resources, and face-to-face (group) and/or face-to-face one-on-one sessions. The primary reasons for closing were: redeployment of staff (41.2%; n = 21 of 51 reasons cited by program managers); facility closure owing to

location within a hospital setting, near acute-care or long-term care facilities (41.2%; n = 21 of 51); reuse of the facility for COVID-19 purposes (9.8%; n = 5 of 51); lack of funding owing to reliance on CR fees (3.9%; n = 2 of 51); patients declined virtual care (2%; n = 1 of 51); and lack of leadership (2%; n = 1 of 51). Some of the program managers cited more than 1 reason for closure.

Open vs closed CRPs

Programs that continued offering ≥ 1 CR service discontinued face-to-face CR sessions from March 10th to April 24th, 2020. Pre-COVID-19 characteristics associated with being open vs closed were larger patient volumes ($P < 0.001$) and prior use of web-based platform resources ($P < 0.001$; [Supplemental Table S1](#)). Both programs that relied on foundation/fundraising closed ($P = 0.05$). During the COVID-19 pandemic, $30.1\% \pm 33.9\%$ of all employees (administrators, managers, clinicians, allied health, etc.) from open CRPs were redeployed, and $47.1\% \pm 37.9\%$ of employees from closed CRPs were redeployed, $P = 0.051$. Furthermore, of the remaining employees (ie, those not redeployed), $17.8\% \pm 30.9\%$ of open-CRP staff, and $22.5\% \pm 33\%$ of closed-CRP staff had their working hours reduced, $P = 0.56$. There was a trend for more open CRPs than closed

Table 2. Actual and perceived facilitators to cardiac rehabilitation (CR) delivery during and before coronavirus disease 2019 (COVID-19) by open and closed programs

Facilitators	Most-cited facilitators during COVID-19				Most-cited facilitators before COVID-19			
	CR (%)	Rank*	No CR (%)	Rank	CR (%)	Rank	No CR (%)	Rank
A monetary fund to provide patients requiring stationary AT equipment to use at home who are unable to afford it (falls risk, MSK issues)	67.4	1	81.8	1	43.2	2	68	1
RT video demonstrating exercises that do not require equipment for frail elderly (low functioning)	63.6	2	63.0	8	40.9	3	48.1	7
RT program package (pictures and instructions) that does not require equipment for frail elderly (low functioning)	56.5	3	70.4	2	33.3	7	44.4	8
Resource with step-by-step instructions on how to prescribe AT without GXT or 6MWT results (remotely and not face-to-face)	54.5	4	66.7	4	31	8	51.9	5
RT video demonstrating exercises that do not require equipment for higher-functioning patients	53.3	5	65.4	7	34.1	6	53.8	3
A monetary fund to provide patients requiring RT equipment to use at home who are unable to afford it	52.3	6	69.6	3	37.8	4	53.8	4
RT program package (pictures and instructions) that does not require equipment for higher-functioning patients	51.1	7	66.7	5	33.3	7	51.9	6
Resource with instructions and tools on how to conduct pre-participation screening (remotely and not face-to-face)	45.2	8	66.7	6	20.5	9	44.4	9
Additional funding	44.7	9	54.5	9	43.9	1	57.7	2
Collaboration with acute care HCPs to ensure appropriate referrals	39.5	10	28.6	10	34.9	5	24	10

Programs that responded “I don’t know” when prompted to rate barriers are not included in the denominator.

AT, aerobic training; GXT, graded exercise test; HCPs, health care professionals; MSK, musculoskeletal, RT, resistance training; 6MWT, 6-minute walk test.

* Rank is based on the proportion of programs that indicated the parameter as more than somewhat helpful to very helpful.

CRPs to report being reimbursed by government/insurance agencies for alternative CR models ($P = 0.056$).

Program eligibility criteria

During the pandemic, eligibility criteria for open CRPs shifted to lower-risk, less-complex patients—specifically, fewer patients with mobility deficits post-stroke, peripheral artery disease, mild and moderate cognitive deficits, and at high medical risk (Supplemental Table S2).

Exercise and education delivery methods

Fewer services were offered by open CRPs during COVID-19, such as initial assessments, consultation with a doctor or nurse, stress management, and group-based nutrition education (Supplemental Table S2). Exercise delivery methods were predominantly telephone, e-mail, mailing of forms/resources, and web-based platform resources. Of a total of 52 respondents from programs currently delivering CR, 35 reported using at least one web-based resource (67.3%). For more information on use of web-based platforms during COVID-19 and ratings by program managers of how useful each one was, see Supplemental Table S3.

Education delivered by telephone increased, but group-based delivery decreased. Both exercise and education services delivered by one-to-one tele-rehabilitation increased, whereas group-based tele-rehabilitation delivery did not change significantly. During the COVID-19 pandemic, 32% (16 of 50 programs) reported using tele-rehabilitation to deliver group and/or one-to-one exercise programming, with 14% (7 of 50 programs) reporting one-to-one only, 4.1% (2 of 49 programs) reporting group only, and 14.3% (7 of 49 programs) reporting both group and one-to-one programming. During the COVID-19 pandemic, 43.5% (20 of 46 programs) reported using tele-rehabilitation to deliver education programming (group and/or one-to-one), with 19.6% (9 of 46 programs) reporting one-to-one only, 6.5% (3 of 46 programs) reporting group only, and 17.4% (8 of 46 programs) delivering both group and one-to-one programming.

Delivery barriers and facilitators

Latent prompted barriers and facilitators (asked to assess significance of 8-15 barriers/facilitators) are presented in Tables 1 and 2. Salient and unprompted barriers and facilitators (asked for the single most important barrier/facilitator) are presented in Supplemental Figure S1.

Discussion

Program closures

Within 2 months of COVID-19 being declared a pandemic, there were reductions in almost all aspects of CR programming and capacity across Canada. Almost half of all responding CRPs were closed, owing largely to redeployment and facility closure. Staffing resources were reduced in almost 60% of all CRPs across Canada, and CRP delivery methods transitioned from traditional group-based face-to-face sessions to less-time-efficient phone-based one-to-one delivery models. Thus, it was not surprising that the second greatest resource barrier to CRP delivery was reported as greater demands on employee time. Regarding reduced staffing, a well-structured model for group-based tele-rehabilitation care would facilitate continued delivery and be a more economical use of staff time. However, experience by provider and patient in using tele-rehabilitation, as well as additional funding to access the technology, need to be addressed. CRP managers reported a need for coverage of tele-rehabilitation technology by the government ministry as an important facilitator of continued service delivery. In addition, reimbursement to CRPs for remote home-based models appeared to have an effect on keeping CRPs open during the COVID-19 pandemic. Therefore, advocating for funding to sustain these programs and supplemental reimbursement for alternative program models should be a priority.¹³ Given the favorable effect of CR on emergency room visits, hospital admissions, and adverse patient outcomes, the consequences of inaction could further diminish health care resources.^{1,9}

Preparing for lack of access to a facility by using a web-based clinical management platform where patient data is stored and can be accessed securely by employees working offsite would allow continued CR programming. Indeed, lack of remote access to hospital servers was reported as a barrier to continuing CR by almost half of CRP respondents.

High-risk and vulnerable populations were disproportionately affected

Only half of the open CRPs that admitted medically high-risk patients before the advent of COVID-19 continued to admit these patients during the pandemic. The decline in eligibility of medically high-risk populations resulted from concerns about inability to provide safe programming at a distance. This issue represented a major concern of CRP managers, who cited safety and efficacy of the exercise prescription and lack of face-to-face interaction during exercise sessions. Inability to monitor patients during pre-participation assessments, such as graded exercise stress testing, and lack of risk stratification added to these concerns. It is especially important to address this gap in services given that CR is likely to be in higher demand per reports of a reduction or delay in people seeking medical help for acute coronary syndromes and worsening heart failure symptoms because of concerns about potential virus transmission.^{2,3,14} This situation may result in more-severe cardiac complications. Furthermore, although much remains unknown, there

are preliminary reports of cardiac involvement during hospitalization for COVID-19.²⁻⁸

Given these issues, program closure and reduced services to high-risk populations may have adverse morbidity and mortality implications and further burden the health care system. Indeed, a recent systematic review and meta-analysis of pre-COVID studies reported that people with heart failure participating in exercise-based CR, compared to no CR, had reduced all-cause and heart failure-specific hospitalizations (relative risk 0.70; 95% confidence interval 0.60 to 0.83; and relative risk 0.59; 95% confidence interval 0.42 to 0.84, respectively).⁹ The consequences of CR closure and/or reduced services may intensify the burden on the health care system. As restrictions ease, priority for onsite risk assessment through graded exercise testing with electrocardiogram and blood pressure monitoring for higher-risk patients should be implemented. In the absence of regular onsite CR sessions, tele-rehabilitation programming and more-sophisticated approaches to in-home monitoring have the potential to mitigate these barriers.¹⁵ Patients at risk for exercise-induced cardiac ischemia and/or arrhythmia would benefit from real-time electrocardiogram monitoring with sensor-based technology.

Vulnerable populations were also disproportionately affected in access to CR. Specifically, people with cognitive deficits, peripheral artery disease, and stroke, as well as those with language/communication barriers, were less likely to be eligible for CR. Providing access to exercise and psychosocial services offered by CRPs to support these patients in managing financial burden, stress, low mood, and depressive symptoms, which may be even more intensified for these patients during the pandemic, should be provided. Efforts to ease eligibility restrictions while maintaining patient and staff safety should be a priority. One strategy highly rated by CRP managers to facilitate inclusion of patients who have mobility issues and are at risk for falls is to provide reimbursement for the purchase of non-weight bearing aerobic training equipment, such as a stationary cycle that could be used in the home. Provision of this equipment would help to address barriers to exercise prescription for other underserved populations, such as post-stroke patients and those with cognitive deficits (4th prompted barrier), and lower-functioning frail patients (7th prompted barrier). As restrictions ease, triaging the vulnerable populations, including those with communication barriers to face-to-face onsite programming, with provision of a translator would facilitate safe entry and prescription.

CRP delivery models

As mentioned previously, tele-rehabilitation programming and sophisticated approaches to in-home monitoring have the potential to mitigate the barriers cited above. However, most of the CRPs were delivering CR by phone, using web-based online platform material, and e-mail, which does not allow observation, monitoring, or assessment of patients. Facilitators of tele-rehabilitation programming included a need for technical support, as well as training for both staff and patients on how to use the technology. Knowledge of the best format of delivery that is hospital approved, and has adequate data protection and compliance with privacy regulations, was also

an important facilitator. Facilitators reflected a need for training CR health care professionals on remote monitoring and pre-participation assessments. Indeed, the need for “upskilling” has been highlighted in a recent review of evidence for delivering cardiovascular health care remotely during the COVID-19 pandemic.¹⁶ Enablers to staff training should focus on the 2 highly ranked resource facilitators of CR delivery, which were provision of a toolkit for remote aerobic exercise prescription when results of a functional or graded exercise stress test are not available, and a toolkit for remote pre-participation screening. The toolkits should include directions for use of technology that includes language-translation capabilities and should be easy to use for the patient. Pre-participation assessments, some of which are not currently included in the Canadian CR guidelines,¹⁷ should comprise cognition, mobility, balance, frailty, vision and hearing ability, as well as standard risk stratification, musculoskeletal health, and cardiorespiratory/functional fitness when possible. Some of these assessments can be conducted virtually. These assessments, as well as knowledge of patients’ access to technology, transportation to the CR centre, and patient program preference, to name a few factors, would allow triaging of patients to an appropriate and safe program model of care.

Need for low-technology resources

Almost half of open-CRP managers cited patients not having access to technology, and difficulty in using it, as primary barriers to education and risk factor—modification delivery. Given that one-third of all CRPs are located in rural areas, many may either not have access to the internet or have poor service. Others may not be able to afford the cost of equipment and/or internet provider or have privacy concerns. These gaps align with the second—most cited unprompted facilitator, which is to provide low/no technology resources/tools such as resistance training program packages with pictures/description of exercises that could be sent by mail and used with over-the-phone guidance from therapists. Digital enabled care can empower patients to take control of their health and offer novel ways to engage people in their CR treatment, but technology is not a solution for every patient. Therefore, multiple program model streams that include a low- or no-technology option should be provided.

Conclusions

Within 2 months of COVID-19 being declared a pandemic, 41% of CRPs were closed. CRP delivery barriers and facilitators reflected the need for tele-rehabilitation services that would allow assessment and risk stratification, as well as monitoring of exercise, particularly for those at high medical risk. Appropriate staff and patient technology training, alternative methods of delivery for patients that do not have access to technology, as well as patient reimbursement for non—weight bearing aerobic training equipment for vulnerable populations were some of the recommendations. Group-based tele-rehabilitation for lower-risk patients would help reduce demands on staff resources and allow time for more individualized programming for higher-risk and

vulnerable populations. Developing policy that provides strategies to open closed CRPs, admitting high-risk/vulnerable populations, and offering group-based tele-rehabilitation should be a national priority.

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Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjcopen.ca/> and at <https://doi.org/10.1016/j.cjco.2020.09.021>.