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Effect of COVID-19 Social Isolation Policies on Rehabilitation After Anterior Cruciate Ligament Reconstruction

Kate E. Webster,*† PhD, Haydn J. Klemm,‡ BFSc, Nutr (Hons), Brian M. Devitt,‡ MD, PhD, Timothy S. Whitehead,‡ MBBS (Hons), and Julian A. Feller,†‡ MBBS (Hons)

Investigation performed at OrthoSport Victoria, Melbourne, Australia, and La Trobe University, Melbourne, Australia

Background: The coronavirus 2019 (COVID-19) pandemic has had a profound impact on health care in Australia. To contain the spread of the virus, strict physical distancing and social isolation policies were implemented from late March 2020. This presented a situation in which patients recovering from anterior cruciate ligament (ACL) reconstruction had limited access to face-to-face supervised rehabilitation and rehabilitation facilities.

Purpose: To explore the impact of social distancing and isolation policies on postoperative rehabilitation in patients after ACL reconstruction.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Patients who had ACL reconstruction from October 2019 until the end of March 2020 (6 months before the implementation of COVID-19 restrictions) completed an online self-report questionnaire containing 5 sections: utilization of health care professionals for rehabilitation, frequency of rehabilitation, patient concerns and attitude, perceived impact on recovery, and changes to employment status. We compared the responses of patients who had surgery in 2019 with those who had surgery in 2020. Statistical analysis was performed using frequency statistics and central tendency measures.

Results: A total of 185 patients (97 men, 88 women) completed the survey, for a 73% response rate. Patients had a mean age of 28 years (range, 13-57 years) and had undergone surgery a mean 4.5 months prior (range, 1.5-8 months). Most patients (80%) maintained face-to-face rehabilitation, predominantly with a physical therapist, regardless of whether their surgery took place in 2019 or 2020; rehabilitation with active, supervised exercises was most common. Almost all patients were performing strengthening exercises (164/185), and most were performing range-of-motion (139/185) and aerobic (123/185) activities at their homes. Patients were minimally concerned about access to supervised rehabilitation and knee reinjury, but they were concerned about access to equipment. Because of COVID-19, 30% were working from home; 17% were on reduced hours and 8% on increased hours; 15% were on leave or unemployed; and 30% reported no change in employment status.

Conclusion: Patients who had undergone ACL reconstruction just before or during the first few months of the COVID-19 pandemic were able to maintain in-person contact with their health professionals during rehabilitation, and they had a positive outlook and managed well despite the restrictions.

Keywords: coronavirus; pandemic; rehabilitation; knee injury; telehealth

Anterior cruciate ligament (ACL) rupture is a common knee injury that usually occurs while playing sport. The most common treatment option is reconstruction surgery, and Australia has the highest incidence per capita of ACL reconstructions in the world.[18] After surgery, patients usually undergo a period of supervised clinic-based rehabilitation, which ideally commences in the early postoperative period for optimal outcomes.[7] Rehabilitation after ACL reconstruction has been studied extensively, but there is no consensus whether supervised clinic-based therapy is comparable to home-based rehabilitation.[1,5,9] Nonetheless, in Australia, most patients choose to attend a clinic-based program.

In response to the initial outbreak of the coronavirus 2019 (COVID-19) pandemic, federal and state governments of Australia imposed several restrictions in different phases. In late March 2020, the federal government imposed strict social distancing rules, and state governments began to close nonessential services, which included gymnasiums. At this time in the state of Victoria and in

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response to the peak of the first wave of infections, stage 3 restrictions were imposed; people could leave their homes for 4 valid reasons: essential supplies, medical treatment, exercise, and work that could not be done from home. Nonurgent elective surgery was also canceled in an attempt to preserve personal protective equipment, minimize utilization of hospital resources, and prioritize staff and beds in the expectation of a surge in COVID-19 hospital admissions. As a result, ACL reconstruction was canceled or delayed. Some form of restriction on nonurgent elective surgery stayed in place until late November 2020. Restrictions began to ease at the beginning of June 2020, but around this time, a second wave emerged that was more widespread than the first. Stage 3 restrictions were therefore reimposed in the first week of July, and they moved to stage 4 in the first week of August in metropolitan Melbourne. All community sport was canceled.

The implementation of these restrictions had a significant impact on the delivery of allied health services. During stage 3, in-person allied health services could operate with a COVID-19 Safe Work Plan in place; however, during stage 4, routine services in private practice were not permitted. In-person services were allowed only when necessary to prevent significant clinical deterioration that would require an increased level of care. Practitioners were encouraged to use telehealth whenever possible in each of these stages. In metropolitan regions, routine care was again permitted from October 28, 2020, after the second wave officially ended with zero cases on October 26.

The effect of these restrictions was to create a situation of physical distancing and social isolation that was unprecedented. It presented a unique situation with limited access not only to face-to-face supervised rehabilitation but also to rehabilitation facilities. This provided a potential opportunity to evaluate a more home-based rehabilitation model. It additionally provided an opportunity to collect baseline data of rehabilitation undertaken during the period of government-imposed restrictions. From these, adaptations that were made can be longitudinally studied and compared with historical data to determine the effects, positive and negative, of the challenges faced and to identify new ways of practice.

The aim of this study was to explore the impact that social distancing and isolation policies had on postoperative rehabilitation in patients after ACL reconstruction in terms of the (1) access to supervised rehabilitation, (2) facilities and equipment available for rehabilitation, (3) type of rehabilitation being performed, (4) concerns and attitudes of patients during this period, and (5) perceived impact of COVID-19 on recovery. It was hypothesized that patients would have reduced access to supervised rehabilitation and equipment and be concerned that the pandemic restrictions would negatively affect their recovery.

METHODS

Study Design and Patients

This was a cross-sectional study conducted in Melbourne, Australia. All patients who had undergone ACL reconstruction from October 2019 until the end of March 2020 were eligible to participate. All operations were performed by 1 of 4 specialist orthopaedic knee surgeons. The same postoperative rehabilitation protocol had been provided to all patients, although individuals undertook their rehabilitation under supervision at their discretion and attended an allied health professional of their choice. The study procedures were approved by an institutional ethics committee.

Rehabilitation Protocol

Weightbearing as tolerated was encouraged from the outset, and no braces or splints were used unless a meniscal repair had been performed. Emphasis was placed on early restoration of active knee extension and quadriceps activation. Progression through the rehabilitation program was guided by the presence of pain and swelling. Participants progressed to riding a stationary bike as soon as they were comfortable, usually between 3 and 4 weeks, and commenced gymnasium exercises from 5 to 6 weeks onward. Running was permitted once there was no knee effusion and quadriceps strength was satisfactory, typically from 12 to 16 weeks postoperatively. Progression to sport-specific drills commenced from 4 months onward, with a gradual return to team training starting around 6 months postoperatively, provided there was no effusion, an essentially full range of motion, good quadriceps strength, and good control of lower-limb stability (eg, during a single-leg squat). Return to competition sport was permitted after at least 1 month of unrestricted full-contact training, typically from 11 to 12 months after surgery onward. Formal return-to-sport testing was not done on a routine basis.

Study Tool

The survey tool was an online self-report questionnaire consisting of 5 sections. Section 1 comprised a set of questions regarding the utilization of health care professionals for rehabilitation management and the mode of service delivery (eg, face-to-face or telehealth). Section 2 contained questions regarding the type and frequency of

*Address correspondence to Kate E. Webster, PhD, School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Victoria 3086, Australia (email: k.webster@latrobe.edu.au) (Twitter: @DrKateWebster).
†School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Australia.
‡OrthoSport Victoria, Epworth HealthCare, Melbourne, Australia.
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rehabilitation exercises being performed as well as the facilities and equipment available for rehabilitation. Section 3 contained questions regarding patients' concerns (eg, not having access to rehabilitation or equipment) and attitudes (eg, ability to meet rehabilitation targets) during this period. Section 4 asked patients to rate the perceived impact of COVID-19 on recovery, and section 5 documented any pandemic-related changes to employment. The full survey is available as Supplemental Material.

Procedures

The survey was electronically set up using the LimeSurvey platform. All 254 patients who had undergone ACL reconstruction within the eligible time frame were sent an email on May 8, 2020, with a link to activate the survey online. Two reminder emails and text messages were then sent over a 2-week period to all patients who had not responded to the initial invitation or to subsequent reminders.

Data and Statistical Analysis

Frequency statistics were conducted to present utilization of health care, type and frequency of rehabilitation exercises being performed, the range of available equipment for rehabilitation, and the impact of the COVID-19 restrictions on recovery. Questions regarding patients' concerns and confidence or attitudes toward rehabilitation and recovery were analyzed with measures of central tendency. A subgroup analysis was performed to examine survey responses according to differences in the time that had elapsed since surgery (ie, patients who had ACL reconstruction in the last 3 months of 2019 vs the first 3 months of 2020). Other subgroup analyses included patients' age, sex, and number of prior ACL injuries. Continuous variables were compared with the Student t test or Mann-Whitney test. The χ^2 test was used to compare categorical variables. Statistical significance was set at $P < .05$. Data analysis was carried out using SPSS Version 25.0 (IBM Corp).

RESULTS

The survey was completed by 185 patients (97 men, 88 women), which was a 73% response rate. Patients who completed the survey had a mean age of 28 years (range, 13-57 years) and had undergone surgery a mean 4.5 months prior (range, 1.5-8 months). For 128 patients, this was their first ACL operation.

Most patients reported that they were in contact with a health care professional regarding their rehabilitation, and the type of health care professional was most frequently a physical therapist (Table 1). Slightly more patients who underwent surgery between January and March 2020 were receiving rehabilitation advice from their treating surgeon as compared with those who had surgery in 2019 (mean ± SD, 3.0 ± 1.0 vs 6.1 ± 0.9 months, respectively, after surgery). Most patients were maintaining face-to-face rehabilitation regardless of whether surgery took place in 2019 or 2020, with a small proportion doing face-to-face and telehealth (10%; 15/145). A similar small proportion were partaking in only telehealth rehabilitation, which was used more by the patient group who underwent surgery at the end of 2019 versus the start of 2020.

TABLE 1
Proportion of Patients by Health Care Provider and Mode of Rehabilitation: Overall and According to Surgery Timing[a]

		Patients by Surgery Timing	
	All Patients	October-December 2019	January-March 2020
In contact with a health care professional	80 (147/185)	72 (63/88)	87 (84/97)
Rehabilitation provider			
Physical therapist	87 (127/146)	90 (56/62)	84.5 (71/84)
Treating surgeon	6 (8/146)	3.3 (2/62)	7 (6/84)
Osteopath	4 (6/146)	3.3 (2/62)	5 (4/84)
Other[b]	3 (5/146)	3.3 (2/62)	3.5 (3/84)
Mode of rehabilitation			
In person	80 (116/145)	79 (49/62)	81 (67/83)
Telehealth	10 (14/145)	11 (7/62)	8 (7/83)
Both	10 (15/145)	10 (6/62)	11 (9/83)

[a]Values are presented as % (No.).
[b]Other included exercise physiologist, personal trainer, or sports physician. One patient did not give the type of rehabilitation provider, and 2 did not provide mode of rehabilitation.

For the 29 patients who were participating in some form of telehealth, this was mostly delivered one-on-one in a live telesession (20/29) and/or via telephone conversation (12/29). A few (7/29) had this supplemented with written resources. No one was using a group format or prerecorded resources.

For in-person and tele-health sessions, the frequency of consultations varied according to the timing of the surgery. Most patients with surgery in 2019 were receiving <1 consultation every 2 weeks when compared with patients with surgery in 2020, who were receiving in-person or telehealth consultations every week or every 2 weeks ($P < .0001$) (Figure 1). Consultations were mostly active rehabilitation sessions of supervised exercise with instruction or demonstration (77%; 111/145) rather than advice (n = 34/145).

For their rehabilitation, almost all patients were doing strengthening exercises (164/185), and most were doing range-of-motion (139/185) and aerobic (123/185) activities. Just more than half (107/185, 58%) were doing quadriceps exercises in extension (Figure 2).

For those doing aerobic activity, overground walking and riding a stationary bike were the most common activities and were performed by more than half of patients (Figure 3).

Patients reported having a range of equipment available to them for their rehabilitation, with resistance

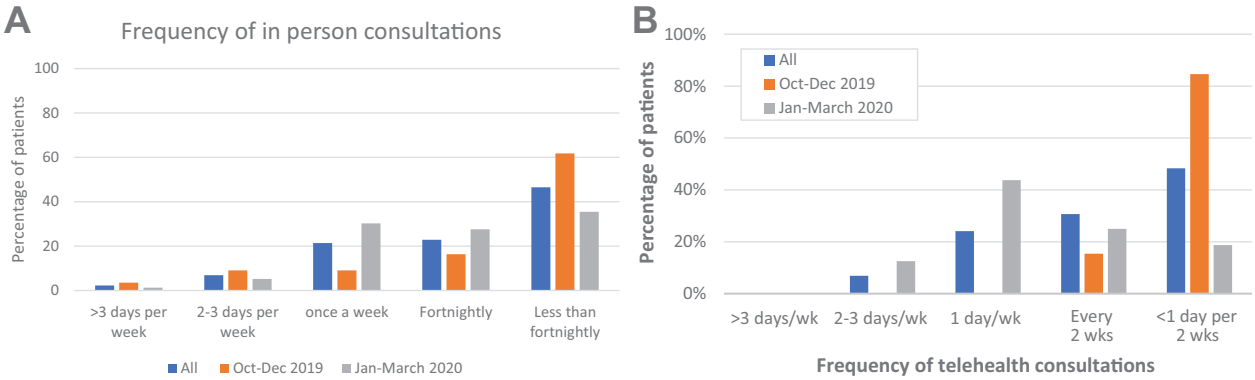

Figure 1. Frequency of (A) in-person and (B) telehealth consultations.

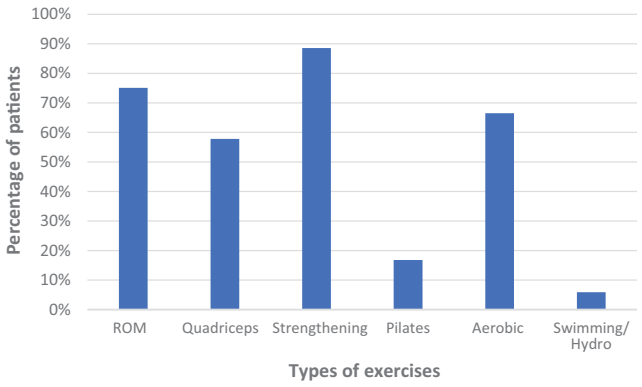

Figure 2. Types of exercises performed by patients as part of their rehabilitation. ROM, range of motion.

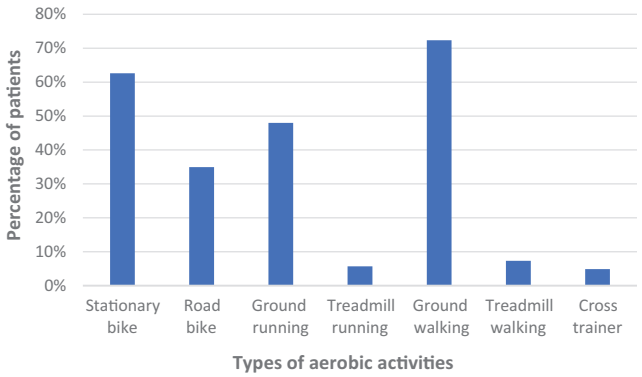

Figure 3. Types of aerobic activities.

bands, dumbbells, and stationary bikes being the most used (Table 2).

The frequency at which patients self-performed their rehabilitation exercises varied depending on the time from surgery. Most patients (74%) who had surgery in 2020 and were on average 3 months postsurgery completed their rehabilitation exercises at least 4 times per week, but just more than half (52%) who had surgery in 2019 and were on average 6.1 months postsurgery

TABLE 2
Equipment Available and Used During Rehabilitation[a]

	Available	Used
Home gym setup/facility	69 (37)	60 (32)
Resistance bands	140 (76)	115 (62)
Barbells	65 (35)	49 (26.5)
Dumbbells	117 (63)	99 (53.5)
Kettlebells	52 (28)	45 (24)
Balance/fit ball	52 (28)	36 (21)
Medicine ball	44 (24)	27 (15)
Stationary bike	108 (58)	93 (50)
Road bike	75 (40.5)	56 (30)
Treadmill	31 (17)	18 (10)
Cross-trainer/elliptical	11 (6)	4 (2)
Rower	14 (8)	8 (4)

[a]Values are presented as No. (%).

completed it with the same frequency (Figure 4). There was no significant difference in the frequency of self-performed rehabilitation exercises between patients for whom this was their first ACL reconstruction (68% completing exercises a minimum of 4 days per week) and those who had prior ACL surgery (75% completing exercises a minimum of 4 days per week; $P = .7$).

On a scale from 0 to 100, with 100 indicating a greater degree of concern, patients appeared minimally concerned regarding their access to supervised rehabilitation (mean rating, 37) and whether this might lead to them reinjuring the knee (mean rating, 31). They were more concerned regarding access to equipment (mean rating, 52). Finally, 69% (128/185) had set targets for their rehabilitation and overall were highly confident (mean rating, 74) they would achieve these targets. The timing of surgery (2019 vs 2020) or having had previous ACL surgery did not influence patients' ratings of concern or confidence; however, younger patients (<25 years) were significantly less concerned about access to supervision or equipment and were more confident in meeting their rehabilitation goals than their older-aged counterparts (Table 3). Patients generally felt positive (mean rating, 70) that they would be able to return to sport after the easing of COVID-19 restrictions. Female

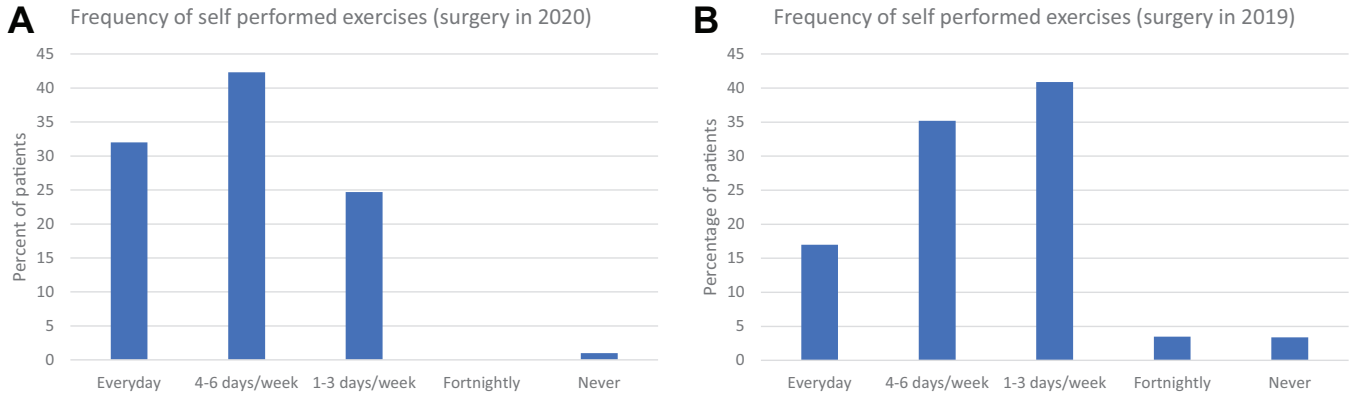

Figure 4. Frequency of self-performed rehabilitation exercises for patients who underwent surgery in (A) 2020 and (B) 2019.

TABLE 3
Questions Regarding Patient Concerns, Confidence/Attitudes, and Coping Ability Toward Rehabilitation and Recovery During COVID-19 Restrictions[a]

	Age, y			Sex		
Question[b]	<25 (n = 92)	≥25 (n = 93)	*P* Value	Male (n = 97)	Female (n = 88)	*P* Value
1. Access to supervised rehabilitation	32 ± 26	43 ± 34	**.01**	33 ± 31	42 ± 30	.06
2. Reinjure knee without supervision	30 ± 27	33 ± 29	.39	28 ± 28	35 ± 28	.13
3. Access to equipment	45 ± 30	58 ± 32	**.005**	45 ± 33	60 ± 28	**.001**
4. Confident achieving rehab targets	79 ± 19	69 ± 25	**.009**	77 ± 25	71 ± 25	.12
5. Confident achieve full recovery	83 ± 20	78 ± 23	.07	82 ± 19	78 ± 21	.21
6. Feeling positive about returning to sport	71 ± 29	70 ± 29	.8	72 ± 29	68 ± 28	.40
7. Extent rehabilitation was affected	60 ± 35	55 ± 32	.31	53 ± 35	63 ± 31	**.04**
8. Ability to cope	78 ± 19	79 ± 20	.69	81 ± 19	76 ± 20	**.045**

[a]Data are reported as mean ± SD. Bold *P* values indicate statistically significant between-group differences ($P < .05$).
[b]For questions 1-3, higher scores reflect greater concern; for questions 4-6, higher scores reflect greater confidence/positivity; for questions 7-8, higher scores reflect greater impact/ability.

patients felt that their rehabilitation had been affected to a greater extent and indicated a lower ability to cope than male patients.

Regarding the impact of social distancing and isolation policies on recovery, just more than half of the surveyed patients thought that it would delay their rehabilitation. However, one-third felt that there would be more time for rest and recovery, particularly those who had surgery at the start of 2020. Finally, 18% thought that there would be no impact, and just less than half of patients believed that their return to sport would be delayed (Table 4). There were no significant differences between patients for whom this was their first ACL reconstruction and those who had undergone prior ACL surgery.

One-third of patients who had surgery in 2019 (33%; 29/88) had been reassured by a treating practitioner that their outcome would not be adversely affected by COVID-19 restrictions, whereas half of those who had surgery in 2020 (51%, 49/97) had received reassurance.

In terms of work demographics, almost one-third (30%) of the patients were students, 28% were office/sedentary workers, and 20% performed light manual work. Because of COVID-19, 30% were working from home; 17% were on reduced hours; 8% were working more hours; 15% were on leave or had become unemployed; and 30% reported no COVID-19–related impact on their employment.

TABLE 4
Patient-Reported Impact of COVID-19 Restrictions on Overall Recovery[a]

	All	2019 Surgery	2020 Surgery	*P* Value
Delayed/slower rehabilitation	102 (55)	54 (61)	48 (50)	.11
Delayed return to sport	82 (44)	44 (50)	38 (39)	.14
Improved/faster rehabilitation	20 (11)	6 (7)	14 (14)	.10
Faster return to sport	8 (4)	2 (2)	6 (6)	.19
Risk of complications				
Increased	33 (18)	14 (16)	19 (20)	.51
Reduced	19 (10)	8 (9)	11 (11)	.62
More time for rest/recovery after surgery	64 (35)	22 (25)	42 (43)	**.009**
No impact	33 (18)	17 (19)	16 (17)	.62

[a]Data are reported as No. (%) of patients. Bold *P* value indicates statistically significant difference between surgery in 2019 and 2020.

DISCUSSION

Findings from the current survey showed that during the COVID-19 pandemic, most patients maintained contact with a health professional, primarily a physical therapist, for rehabilitation after their ACL reconstruction. For those who maintained contact, face-to face rehabilitation with active supervised exercises was utilized for 80% of the patients. A small proportion (16%) of patients were receiving telehealth. Patients were minimally concerned about access to supervised rehabilitation and knee reinjury but were concerned about access to equipment.

It was somewhat surprising that most patients were receiving in-person (face-to-face) contact, as social distancing rules had been put in place and telehealth was advised. However, the timing of the survey was during the first phase of lockdown, when restricted face-to-face treatment was still permitted. Therefore, patients and therapists may have perceived the risk of COVID-19 transmission associated with in-person supervised physical therapy to be minimal at that time. This finding may equally highlight the high regard and importance that patients placed on receiving supervised physical therapy. However, slightly more patients with surgery between January and March 2020 were receiving rehabilitation advice from the treating surgeon as compared with 2019 (7% vs 3.3%, respectively), indicating that the surgeon had perhaps taken on a greater role in rehabilitation as physical therapy services were increasingly being restricted.

It is noteworthy that such a small proportion of patients utilized telehealth (16%), and for most this was a supplement to in-person supervised treatment. However, this should not necessarily be interpreted to suggest that patients do not value telehealth. As the survey was conducted in the relatively early phase of the pandemic, it is possible that the availability of telehealth services may have been limited, and we asked patients only what services they used rather than what was offered. It would have been interesting to examine whether the utilization of telehealth services increased during stage 4 restrictions, when face-to-face services were extremely limited. However, this could not be evaluated as ACL reconstruction also ceased during this stage owing to its classification as nonurgent and compounded by the lack of people participating in sport, similar to the surgical reductions seen in other counties.[12] A recent meta-analysis[3] reviewed patient and surgeon satisfaction with telehealth in orthopaedic care and concluded that its use resulted in satisfaction and patient-reported measures of pain and function comparable to in-person assessments. Patients additionally noted considerable time savings. As such there may be a role for telehealth to become a regular feature of rehabilitation practices, and future work should capture relevant outcomes, including complications, to ensure that patient care is not compromised.

Patients' greatest concern was a lack of access to equipment for rehabilitation, which is not surprising as gymnasiums were required to close. Perhaps as a secondary effect of this, more than half of the patients believed that the COVID-19 restrictions would delay their recovery because their rehabilitation was progressing at a slower rate than normal. However, for the most part, these patients had a positive attitude and were highly confident that they could meet their rehabilitation targets and achieve a full recovery. They were also optimistic about returning to sport. The extent to which these findings are specific to the large metropolitan clinic in which this study was conducted is difficult to ascertain, and other factors (eg, cost of rehabilitation) may play a confounding role.

The optimistic view that the current patient cohort displayed may be related to the relatively young age of patients who undergo ACL reconstruction. There were, though, some differences between the age groups, with patients <25 years old less concerned and more confident than older patients. Factors such as this may be relevant to the higher reinjury rates that have been reported for younger athletes.[6,10,14-17] There were also some sex differences. When compared with male patients, female patients appraised the impact of the COVID-19 restrictions on their rehabilitation to be greater and reported a reduced ability to cope. This aligns with previous findings showing lower return-to-sport rates in female patients versus male patients.[2] It is also consistent with recent data from pre- and postoperative sports medicine, which has shown that female patients more frequently report anxiety and concerns regarding COVID-19–related health care closures as compared with male patients.[11]

Despite limited access to rehabilitation facilities and gymnasiums, patients were still able to undertake a variety of rehabilitation exercises, and many supplemented these with small equipment items, such as resistance bands and dumbbells. As might be anticipated, the frequency at which rehabilitation exercises were performed reduced as the time from surgery increased. However, this is unlikely to have been caused by COVID-19 restrictions and more likely reflects the usual situation.

A notable portion (70%) of the patient cohort had COVID-19–related changes to their employment, such as working from home, reduced hours, or no longer working (on leave or unemployed). This likely had positive and negative ramifications. Working from home may have provided greater time and opportunity to undertake rehabilitation. However, working from home has been associated with a greater time spent in sedentary behaviors (sitting and screen time).[13] Early statistics showed that younger people, particularly those in their 20s, were significantly affected by COVID-19 in terms of reduced work hours or job loss,[4] and these job insecurities are associated with poorer mental health.[8] As many who undergo ACL reconstruction are within this demographic, it is possible that the emotional consequences of employment uncertainty may interact with recovery. Future work will be required to examine whether patients who underwent ACL reconstruction just before or during the pandemic have comparable outcomes.

The limitations of this work include the geographically specific nature of the COVID-19 restrictions that were imposed, and it is unclear how generalizable the current findings are to other settings. All collected data were self-reported, and while patients were responding to their current situations and the response options should have been

straightforward to answer, no accuracy checks could be made. Finally, the COVID-19 situation was continually evolving and changing, often on a daily basis, throughout the period of data collection, and it is unknown how this may have affected patients' responses and views. Despite these challenges, it was relevant to document the impact of social distancing and isolation policies on access to rehabilitation during this unique situation. Clinically, we learned that this patient cohort was highly resilient, prioritized face-to-face rehabilitation, and remained greatly optimistic about resuming sports participation. Data such as these may also provide important baseline data that can be used to determine any longer-term impacts of having undergone ACL reconstruction during a time of social distancing and isolation policies. It is unclear whether similar resilience would be found in patients who had surgery postponed for lengthy periods because of COVID restrictions or who had undergone surgery for trauma.

CONCLUSION

Patients who had undergone ACL reconstruction just before or during the first few months of the COVID-19 pandemic were able to maintain in-person contact with their health professional for rehabilitation. Telehealth was not extensively utilized at this time. Overall, patients had a positive outlook and managed well despite the restrictions.

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