

Validation of a Survey to Characterize Barriers to Physical Activity After Anterior Cruciate Ligament Reconstruction

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Context: Although 84% of patients expected to return to activity within 1 year of anterior cruciate ligament (ACL) reconstruction (ACLR), as few as 24% will return to their preinjury level of activity. By considering a patient's perceptions of reengagement in activity after ACLR, clinicians and researchers may be better equipped to implement interventions that are patient centered.

Objective: To describe the validation of the ACL Reasons survey, a tool to aid clinicians and researchers in understanding patient perceptions of barriers to physical activity (PA) engagement after ACLR.

Design: Cross-sectional study.

Patients or Other Participants: The ACL Reasons survey was administered via Qualtrics to 78 patients 6 to 24 months after primary, unilateral ACLR. Patients were categorized as active, more challenging, or less active based on their responses to the ACL Reasons.

Main Outcome Measure(s): Development of the ACL Reasons survey occurred via an iterative process of drafting and revising based on feedback from a team of external expert reviewers. Tegner activity level, Marx activity score, the Knee injury and Osteoarthritis Outcomes Score (KOOS), ACL Return

to Sport after Injury score, and Tampa Scale of Kinesiophobia score were compared among groups using analysis-of-variance and Kruskal Wallis tests.

Results: Groups differed based on Tegner activity level ($P < .001$), Marx activity score ($P = .01$), KOOS pain score ($P = .02$), KOOS symptom score ($P = .04$), KOOS sports and recreation score ($P < .001$), KOOS quality of life score ($P < .001$), ACL Return to Sport after Injury score ($P < .001$), and Tampa Scale of Kinesiophobia score ($P < .001$), with the less active group performing worse on each. Knee symptoms, fear of knee symptoms or movement, and fear of injury were the most common reasons for the change in PA engagement.

Conclusions: These results support the validity of the ACL Reasons survey as a tool for identifying barriers to PA engagement after ACLR. This tool may help facilitate communication between patients with ACLR and their health care providers to enhance patient-centered care.

Key Words: patient-reported outcome measures, patient-centered care, qualitative tool

Key Points

- The ACL Reasons survey is a valid, evidence-based, and clinically feasible qualitative tool that can be administered to evaluate patient perceptions of barriers to physical activity reengagement after anterior cruciate ligament injury.
- Knee symptoms, fear of knee symptoms or movement, and injury-related fear were the most reported reasons for changes in physical activity among participants in this study.
- The ACL Reasons survey can be used to facilitate patient and health care provider communication and enhance patient-centered care and through targeted interventions for patients with anterior cruciate ligament reconstruction.

Anterior cruciate ligament (ACL) reconstruction (ACLR) is one of the most common sports medicine procedures performed in the United States among physically active individuals aged 13 to 30 years.¹ Many individuals with ACLR consider full return to sport (RTS) an indicator of successful recovery.² However, patient expectations regarding RTS after ACLR are often disconnected from patient experiences.² Although 84% of

patients expected to make a full RTS within 1 year of ACLR,² the authors³ of a recent study indicated that as few as 24% of patients returned to their preinjury level of activity. This is especially concerning because, for many adolescents and young adults, sport serves as the primary source of physical activity (PA), promotes enhanced mental health and quality of life, and facilitates healthy social engagement.^{4–6}

Table 1. Developers and Expert Reviewers Involved in Face Validation of the ACL Reasons Survey

	Round 1	Round 2
Survey Developers		
PhD-trained athletic trainer who is a faculty member at an R1 institution with 14 years of research experience (male)		
PhD-trained sports medicine researcher who is a faculty member at an R1 institution with 8 years of research experience (female)		
PhD-trained athletic trainer who is a postdoctoral researcher with 8 years of research experience (female)		
Expert Reviewers		
Athletic trainer in an outpatient rehabilitation clinic (female)	Yes	No
PhD-trained athletic trainer who is a faculty member at an R1 institution (male)	Yes	Yes
PhD-trained athletic trainer who is a faculty member at an R1 institution (male)	Yes	No
Doctor of physical therapy with a PhD who is a researcher at an R1 institution (female)	Yes	Yes
Doctor of physical therapy with a history of ACLR (female)	Yes	No
24-year-old patient with a history of ACLR (female)	Yes	Yes
26-year-old patient with a history of ACLR (female)	Yes	No

Abbreviation: ACLR, anterior cruciate ligament reconstruction.

Failure to RTS is well documented after ACL injury and ACLR, yet persistent reductions in PA participation among adolescent and young adult patients are also common. For example, during the first 5 years after ACLR, patients who self-reported successfully returning to sport were 2.4 times less likely to meet US Department of Health and Human Services recommendations for weekly aerobic PA participation (ie, weekly minutes of moderate-to-vigorous PA participation) when compared with healthy individuals of similar ages and patient-reported activity levels.⁷ Additionally, only 27.1% of high school-aged adolescents⁸ and 24.3% of adults⁹ in the United States met the World Health Organization aerobic PA guidelines.^{10,11} Physical inactivity early in the lifespan is a highly prevalent risk factor for chronic disease,¹² and ACLR may amplify this troubling behavior. As such, developing and implementing tools to enhance patients' PA participation and improve the underlying reasons for changes in their PA behaviors may play a critical role in targeting patient-centered interventions that meet the need for a safe and lasting reengagement in PA participation after ACLR.

A patient's ability to return to the preinjury activity level is often based on a combination of physical, psychological, environmental, and social factors that are specific to the individual.¹³ Regardless of musculoskeletal injury, barriers to PA participation include lifestyle changes, lack of access to facilities, and financial burdens.¹⁴ Commonly reported barriers to reengagement in sport or recreational PA after ACLR include knee symptoms, injury-related fear, and the loss of a role on their sport team.¹³ These barriers to PA participation have different underlying causes and require patient-centered and impairment-focused interventional strategies.¹³ Current assessment paradigms such as patient-reported function, leg strength, functional performance, and psychological response to injury provide enhanced understanding of a patient's overall readiness for RTS or PA participation. However, these assessment approaches mainly quantify the magnitude of functional limitation that is present at the time of evaluation rather than identifying patients' perceived barriers to PA participation that are most important to them or are most likely to diminish their success in achieving activity-related goals (eg, RTS) after ACLR. In addition, current commonly used patient-reported outcome measures do not capture barriers such as a lack of time or financial resources or access to facilities, which are important social determinants of health that may meaningfully affect PA participation in patients with ACLR.¹⁵ In qualitative studies, patients with ACLR indicated that current assessment paradigms do not consider a variety of social, physical, and psychological

barriers to activity. Patients with ACLR have also noted variations in clinical interviewing techniques among rehabilitation clinicians, resulting in inconsistent opportunities for patients to describe the perceived barriers.^{13,16,17} Therefore, patients and clinicians may benefit from a structured and standardized approach to assessing patient perceptions of barriers to returning to PA participation using a clinically feasible and validated assessment tool.

By considering patients' perceptions of reengagement in PA, clinicians and researchers may be better equipped to provide a holistic approach to the rehabilitation process, including (1) understanding why patients may struggle to return to their preinjury level of PA, (2) the development of an individualized evaluation based on patient-reported concerns, and (3) the implementation of interventions that center on patients' needs. Thus, the first purpose of our study was to describe the development and validation of the ACL Reasons survey, a new tool to aid clinicians and researchers in understanding patients' perceptions of their PA engagement. The second purpose was to describe patient-identified reasons for changes in PA engagement after ACLR using the ACL Reasons survey.

METHODS

This study consisted of 2 phases. The development phase occurred at a single research site, and the validation phase occurred across multiple sites with a cross-sectional study design.

Phase 1: Development of the ACL Reasons Survey

A team of 3 PhD-trained scientists (C.K., A.T., C.L.) with a minimum of 5 years of experience investigating barriers to PA among patients with ACLR developed the initial version of the ACL Reasons survey. A brief description of each developer can be found in Table 1. The purpose of this qualitative patient-reported outcome measure is to allow individuals with ACLR to characterize their current activity level relative to their preinjury PA level (item 1) and then rank the reasons for the perceived change in their activity level from a list of evidence-based options (item 2). The first item was based on reports^{13,17} of persistent reductions in¹⁸ and patient-reported barriers to PA after ACLR. The initial draft of item 1 is shown in Table 2. The second item was based on qualitative studies in which individuals with ACLR related that a lack of understanding regarding the normal course of physical and psychological progression during rehabilitation often led to challenges in communicating ongoing concerns and

Table 2. Comparison of Item 1 Between the Initial Draft and Final Version of the ACL Reasons Survey

Initial Version of Item 1

1. I am as physically active as I was prior to my most recent ACL injury.
2. I am as physically active as I was prior to my most recent ACL injury, but it is more challenging to participate in PA.
3. I am less physically active than I was prior to my most recent ACL injury.

Final Version of Item 1

1. I am as physically active as I was prior to my most recent ACL injury.
2. I am as physically active as I was prior to my most recent ACL injury; however, it is now more physically or mentally challenging to participate in PA.
3. I am less physically active than I was prior to my most recent ACL injury.

Abbreviations: ACL, anterior cruciate ligament; PA, physical activity.

perceived barriers to a full return to activity.^{16,17} If participants indicated that they were less active or that activity was more physically or mentally challenging, item 2 asked them to select reasons for the change in activity level or challenges associated with activity participation (Table 3). Respondents were then asked to rank the selected reasons based on the degree to which they influenced participation in activity. No limit was put on the number of reasons that could be selected in item 2. Item 2 of the initial version of the ACL Reasons survey listed 24 potential physical, psychological, and environmental or social reasons for the change in PA (Table 3).

Final Version of the ACL Reasons Survey. The initial draft of the ACL Reasons survey was distributed to a group of expert external reviewers (N = 7) consisting of researchers, clinicians, and individuals with a history of ACLR (Table 3) to establish face validity. Reviewers were given a standardized feedback questionnaire to provide structured and semistructured feedback about the utility of the survey and the structure and clarity of the items. Based on feedback from the reviewers, the response options to item 1 were revised as described in Table 2, and the choices available for selection in item 2 were reduced from 24 to 14 (Table 3) due to perceived redundancy, lack of clarity, and lack of importance. After these edits, the ACL Reasons survey was distributed to a subset of the external reviewers (n = 3) for additional feedback using the same standardized questionnaire (Table 1). The reviewer feedback is summarized in the Supplemental Material (available online at <http://dx.doi.org/10.4085/1062-6050-0436.22.S1>). After receipt of feedback from this subset of reviewers, we made minor revisions, such as spelling and grammatical corrections. After the final revisions, the 3 reviewers achieved consensus via email, approving the final version of the ACL Reasons survey.

Phase 2: Cross-Sectional Construct Validation of the ACL Reasons Survey

The ACL Reasons survey was distributed to a group of patients who were 6 to 24 months post-ACLR. Cross-sectional construct validity of the ACL Reasons survey was then established by comparing the activity level groups identified by the ACL Reasons survey with previously validated measures of activity level and knee-related function. The study protocol was approved by the Michigan State University Institutional Review Board (protocol #00002816)

Table 3. Description of Item Reduction and Editing Between the Initial Draft and Final Version of the ACL Reasons Survey

Initial Version

- Physical reasons
 - Knee pain
 - Knee symptoms other than pain (ie, swelling, locking, or catching)
 - Other health concerns
 - Orthopaedic injury since your more recent ACL injury
- Psychological reasons
 - Fear of knee pain
 - Fear of activity or movement
 - Fear of injury (not including ACL injury)
 - Fear of ACL injury
 - Concern that activity will worsen your knee health
 - Concern that activity will lead to arthritis
 - Lack of motivation
- Social or environmental reasons
 - Loss of position on a sport team
 - Lack of interest in returning to sport
 - Insufficient rehabilitation
 - Lack of time
 - Lack of opportunity to participate in sport
 - Disappointment about performance when attempting activity
 - Work schedule or demands
 - Family or childcare responsibilities
 - Lack of access to exercise facilities
 - Lack of money or financial reasons
 - Lack of social support
 - Life milestone or life change (eg, high school to college transition)

Final Version

- Physical reasons
 - Knee symptoms (eg, pain, swelling, locking, or catching)¹⁹
 - Other health concerns¹⁹
- Psychological reasons
 - Fear of knee symptoms or movement^{20,21}
 - Fear of injury²²
 - Concern that activity will worsen your knee health²³
 - Lack of motivation or interest²⁴
- Social or environmental reasons
 - Loss of position or role on a sport team¹⁹
 - Insufficient rehabilitation (ie, physical therapy)²⁵
 - Lack of time²⁶
 - Lack of access to a sports team or exercise facility¹⁶
 - Disappointment in your performance when you attempted activity²⁶
 - Lack of money or financial resources²⁷
 - Lack of social support from friends or family²⁸
 - Life milestone or life change (eg, high school to college transition)⁶

Abbreviation: ACL, anterior cruciate ligament.

and the University of North Carolina at Chapel Hill Institutional Review Board (protocol #21-0437). Participants ≥ 18 years old provided written informed consent. Those < 18 years old provided written informed assent, and 1 parent provided written informed consent.

Participants With ACL Reconstruction. Participants were recruited from a university-affiliated sports medicine clinic at a large state university in the Midwest and the university community at a large state university in the Southeast region of the United States. At both sites, consecutive patients who met the inclusion criteria completed the ACL Reasons survey as a part of involvement in larger ongoing prospective research studies, in which we are investigating the predictors of clinical outcomes in individuals with ACLR. Participants were at least 13 years old; 6 to 24 months after primary, unilateral ACLR; and had been cleared by their surgeons for unrestricted participation in PA. We selected this postsurgical period because it coincides with the

typical transition from standardized care to unrestricted activity²⁹ as well as the period during which patients are exposed to the greatest risk of secondary ACL injury after ACLR.³⁰ Volunteers were excluded if they underwent multi-ligament reconstruction at the time of ACLR. Adherence to the inclusion and exclusion criteria was confirmed using formal chart review and a supplementary demographics survey. Additionally, to better characterize the socioeconomic characteristics of our sample, we used participants' home addresses to determine their Area Deprivation Index (ADI) national percentile.¹⁹ The ADI ranks neighborhoods by socioeconomic disadvantage compared with the rest of the country based on income, education, employment, and housing quality within the block groups defined by the United States Census.²⁰ An ADI of 1 indicates the least area deprivation, and an ADI of 99 indicates the greatest area deprivation.

Cross-Sectional Construct Validation. The final draft of the ACL Reasons survey was administered via an online survey platform (Qualtrics) as a component of a larger battery of patient-reported outcome measures. The online version and a preliminary pen-and-paper version of the ACL Reasons survey are publicly available for download (<https://doi.org/10.18130/V3/HGAQB3>). Participants also completed 5 patient-reported outcome measures to establish cross-sectional construct validity: the Tegner Activity Scale,²¹ Marx Activity Scale, Knee injury and Osteoarthritis Outcome Score (KOOS),²⁴ ACL-Return to Sport after Injury (ACL-RSI) scale,²² and Tampa Scale of Kinesiophobia (TSK-11).²³ The Tegner Activity Scale characterizes the peak level of activity before ACL injury and at the time of assessment. The Marx Activity Scale assesses the frequency and types of activity in which participants engaged at the time of assessment. The KOOS subscales measure pain, symptoms, activities of daily living, sport and recreation, and quality of life. The ACL-RSI evaluates psychological readiness for sport, including emotions, confidence in performance, and risk appraisal related to reengagement in sport after ACLR. The TSK-11 assesses the fear of movement associated with the individual's ACLR. Greater scores on the Tegner Activity Scale, Marx Activity Scale, KOOS, and ACL-RSI indicate better peak activity, greater activity frequency, better self-reported knee function, and better psychological readiness. Lower scores on the TSK-11 indicate increased fear of movement.

Statistical Plan

Participants were grouped based on their response to item 1 of the ACL Reasons survey as active, more challenging, or less active. Continuous variables were summarized using means and SDs. Categorical variables were presented as frequencies and compared among groups using χ^2 tests. To establish cross-sectional construct validity, we reported continuous patient-reported outcome measures as means and SDs and compared activity groups using 1-way analyses of variance. Ordinal patient-reported outcome measures were described as medians and interquartile ranges and compared among activity groups using Kruskal-Wallis tests. To characterize the reported barriers to PA, the frequency of each response was recorded, and the percentage of the total sample represented in each activity group was calculated. For the less active and more challenging groups, the percentage of participants who selected each reason as their top choice and as a choice at any level of importance were determined. The a priori α level was established as $P <$

.05, and analyses were completed using an open-source statistical package (version 1.6; jamovi).

RESULTS

Cross-Sectional Construct Validation

A total of 78 participants completed the ACL Reasons survey at 10.9 ± 5.3 months after ACLR (Table 4). The activity level groups differed based on their post-ACLR Tegner activity level ($P < .001$), change in Tegner activity level from pre-ACLR to the time of assessment ($P < .001$), Marx activity score ($P = .01$), KOOS pain score ($P = .02$), KOOS symptom score ($P = .04$), KOOS sports and recreation score ($P < .001$), KOOS quality of life score ($P < .001$), ACL-RSI score ($P < .001$), and TSK-11 score ($P < .001$), with the as active group performing best and the less active group performing worst (Table 4).

Description of ACL Reasons Survey Responses

Among participants, 41.0% stated that they were as active as before ACLR; 30.8% stated that they were as active as before surgery, but it was more mentally or physically challenging; and 28.2% indicated that they were less active than before ACLR. The groups did not differ based on demographics, the time since surgery, the graft source used at the time of ACLR, or the pre-ACLR Tegner activity level. Respondents in the less active group reported and ranked a median of 5 [5] reasons for their change in activity, whereas the more challenging group reported a median of 4 [2] reasons for activity being more challenging. Within the more challenging and the less active groups (Figure 1), knee symptoms (more challenging = 20.0%, less active = 14.3%), fear of knee symptoms or movement (more challenging = 28.0%, less active = 14.3%), and injury-related fear (more challenging = 16.0%, less active = 19.0%) were commonly cited as the most important barriers. When ranks at any level of importance were considered, concerns that activity would worsen knee health (more challenging = 60.0%, less active = 61.9%) and disappointment in performance when attempting activity (more challenging = 64.0%, less active = 61.9%) were also selected frequently (Figure 2).

DISCUSSION

The ACL Reasons survey was developed to enable patients to describe their perceptions of changes in activity level since the time of injury and report significant barriers to activity in a standardized manner. Face validation was completed via an iterative process, and the cross-sectional construct validity of the ACL Reasons survey was established based on the presence of group differences in patient-reported activity level, several KOOS subscale scores, and psychological response to injury. Development and validation of the ACL Reasons survey is a first step toward providing patients with the opportunity to communicate their perspectives in a standardized manner during assessments after ACLR and enabling clinicians to better understand factors that may negatively influence patient reengagement in PA after ACLR.

Patients in the as active, more challenging, and less active groups differed based on their current Tegner activity level, Marx activity score, all KOOS subscale scores except for activities of daily living, ACL-RSI score, and TSK-11 score.

Table 4. Demographic and Surgical Characteristics and Patient-Reported Outcome Measure Participants' Responses

Characteristic	All Participants	Category			P Value
		As Active (41.0%)	More Challenging (30.8%)	Less Active (28.2%)	
No. (% female)	78 (59.0)	32 (62.5)	24 (54.2)	22 (59.1)	.82
Age, mean ± SD, y	21.6 ± 8.6	20.2 ± 6.7	23.1 ± 11.6	22.1 ± 7.1	.48
Body mass index, mean ± SD, kg/m ²	25.9 ± 5.3	25.5 ± 4.9	26.5 ± 6.5	25.8 ± 4.5	.81
National Area Deprivation Index percentile (interquartile range)	48 (33)	50 (40)	49 (32)	44 (27)	.09
Race, No.					.16
African American	10	5	3	2	
American Indian	1	0	0	1	
Asian	2	0	0	2	
Patient declined to state	13	6	5	2	
Other race	2	0	0	2	
White	50	21	16	13	
Ethnicity, No.					.99
Hispanic or Latino	3	1	1	1	
Non-Hispanic or Latino	55	22	17	16	
Patient declined to state	20	9	6	5	
Months since surgery, mean ± SD	10.9 ± 5.3	11.1 ± 5.3	10.0 ± 5.0	11.5 ± 5.7	.59
Graft source, No.					.40
Bone-tendon-bone autograft	19	6	8	5	
Hamstrings autograft	50	24	12	14	
Quadriceps tendon autograft	2	1	1	0	
Hamstrings allograft	7	1	3	3	
Tegner activity level					
Preinjury	9 (2)	9 (1)	9 (2)	9 (2)	.36
Current	7 (4)	9 (2)	7 (3)	5 (3)	<.001 ^a
Change	-2 (3)	0 (1)	-2 (1)	-3 (2)	<.001 ^a
Marx Activity Score	13 (7)	16 (4)	12 (7)	11 (12)	.01 ^a
		Mean ± SD			
Anterior Cruciate Ligament Return to Sport after Injury score	69.0 ± 25.3	83.6 ± 16.3	66.6 ± 18.7	50.4 ± 29.6	<.001 ^b
Knee injury and Osteoarthritis Outcomes Score					
Pain	93.4 ± 7.1	96.0 ± 5.1	91.7 ± 7.0	91.7 ± 8.7	.02 ^b
Symptoms	73.5 ± 15.0	77.7 ± 14.9	67.3 ± 14.5	74.2 ± 14.1	.04 ^b
Activities of daily living	98.1 ± 3.7	99.2 ± 2.2	98.0 ± 3.2	96.7 ± 5.3	.062
Sports and recreation	86.2 ± 16.0	94.1 ± 8.1	84.8 ± 9.2	76.1 ± 23.4	<.001 ^b
Quality of life	69.7 ± 20.1	82.6 ± 15.0	63.3 ± 15.3	58.0 ± 21.1	<.001 ^b
Tampa Scale of Kinesiophobia-11 score	19.4 ± 5.6	16.1 ± 4.2	20.9 ± 5.2	22.6 ± 5.3	<.001 ^b

^a Differences among the as active, more challenging, and less active groups ($P < .05$) using a Kruskal-Wallis Test.

^b Differences among the as active, more challenging, and less active groups ($P < .05$) using 1-way analysis of variance.

These results support the cross-sectional construct validity of the ACL Reasons survey. In all cases, the as active group reported the highest activity level, psychological readiness, and self-reported knee function, followed by the more challenging group and the less active group. Furthermore, individuals in the more challenging group reported lower current Tegner and Marx activity levels than the as active group, despite no difference between groups in preinjury Tegner activity levels. Therefore, patients who found that returning to activity was more challenging may engage in a lower intensity or amount of activity. These findings align with those of a recent qualitative study²⁵ in which patients recovering after ACLR reported exerting greater mental and physical effort to engage at the preinjury level of activity.

Our results further indicate that psychological factors may negatively affect PA engagement in patients after ACLR. The most frequently cited reasons for modifying PA in the less active group were injury-related fear, fear of knee symptoms and movement, disappointment in performance when attempting activities, and concerns that activity would worsen knee health. According to Filbay et al,²⁶ patients who ceased sports participation commented that they transitioned to an inactive

lifestyle due to fear-avoidance behaviors. Patients with a strong preference for competitive sport over recreational exercise made this transition, which led to deficits in their quality of life.²⁶ In the current research, the more challenging group indicated that injury-related fear and fear of knee symptoms and movement were their most common challenges to PA. Failure to assess psychological responses, such as through the ACL Reasons survey, and failure to intervene to modify maladaptive responses to injury may contribute to the sequelae of poor outcomes observed after ACLR, including reduced PA participation.

Clinicians can use the ACL Reasons survey to bridge the gap between clinical interviews and targeted quantitative assessments to enhance patient-centered care and interventions. Quantitative patient-reported outcome measures such as the ACL-RSI and the TSK-11 provide insight into self-reported injury-related fear, confidence, and risk appraisals. However, clinicians may rely on the identified cutoff scores only to guide treatment decisions rather than use these surveys to facilitate a clinical interview. These conversations are important for identifying specific psychological constructs that may be the underlying source of PA modification and assisting with the development of a specific treatment

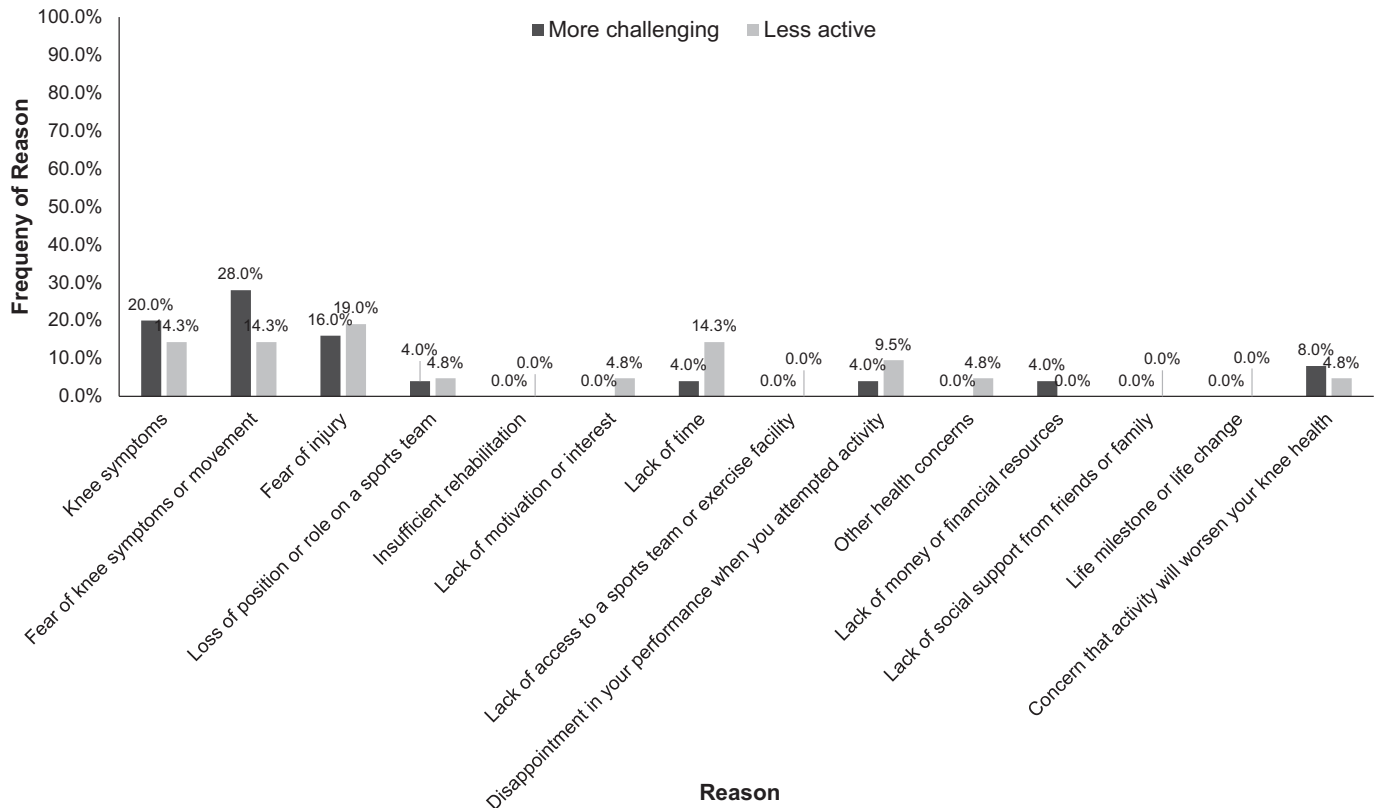


Figure 1. Frequency of reasons selected as the 1st choice by participants in the more challenging and less active groups.

approach or referral to mental health professionals. For example, if a patient states that fear of reinjury is the primary barrier to reengagement in PA, a clinician may be able to (1) evaluate the fear of reinjury using a measure such as the TSK-11, (2) conduct motivational interviewing to better understand the cause and manifestation of the patient's fear, and (3) develop a patient-centered plan of care, which could include integration of targeted techniques, such as graded exposure therapy, to address the patient's fear of reinjury after ACLR.²⁷ In this case, the ACL Reasons survey is used to identify the specific construct that is a barrier for the patient so that the appropriate assessment and interventions can be implemented in a more efficient manner. This is important because assessment and treatment of injury-related fear through evidence-based approaches can look vastly different than treatment for diminished knee-related function, the presence of knee pain, or the loss of a role on a sport team, which are all commonly reported in this patient population.

Quantifying the prevalence of return to preinjury levels of sport is an often discussed indicator of clinical success after ACLR. In a meta-analysis, 66% of individuals who were active in sport before ACL injury described a return to preinjury levels of activity less than 24 months after ACLR.²⁸ As an initial step in establishing the face validity of the ACL Reasons survey, we characterized the rate at which patients conveyed making a return to their preinjury level of activity, with or without significant mental or physical challenges. In our examination, 71.8% of patients indicated a return to preinjury levels of activity at 10.9 ± 5.3 months after ACLR, which is consistent with earlier studies that focused solely on sport participation. However, 30.8% of patients reported significant mental or physical challenges associated with involvement at their preinjury level of activity at their

current stage in recovery. This is the first time that the prevalence of patients reporting mental or physical challenges after returning to preinjury levels of activity has been determined. Authors of prior studies have largely relied on characterizations of activity status based solely on whether a patient made a successful return to the preinjury activity level after surgery. Thus, this approach may miss an important subgroup of individuals who are still experiencing meaningful challenges despite their success in reengaging in activity.

The ACL Reasons survey is neither designed nor validated for use as a quantitative patient-reported outcome measure to assess the severity of barriers to PA or the effects of clinical interventions on these barriers. Previous qualitative researchers^{13,31} found physical, psychological, environmental, and social barriers to activity reengagement. More than 80% of individuals who were less active and 60% of individuals who were as active but cited activity participation as more challenging noted modifiable barriers to PA related to knee concerns. In comparison, fewer individuals encountered environmental or societal barriers such as lack of time, lack of access to facilities, lack of financial resources, lack of social support, and lifestyle changes. Although all barriers to activity engagement are concerning, addressing modifiable factors of knee-related concerns, including injury-related fear and knee symptoms, should be the focus of health care providers. Health care providers should also address patient concerns that activity will worsen their knee joint health by educating patients on the importance of exercise in maintaining knee joint health. Accumulating evidence supports the role of PA participation in improving knee symptoms and perhaps chondroprotection.³² Future investigators should explore the responsiveness of this survey (1) over the course of recovery after ACLR, (2) to changes in PA levels during recovery after ACLR, and (3)

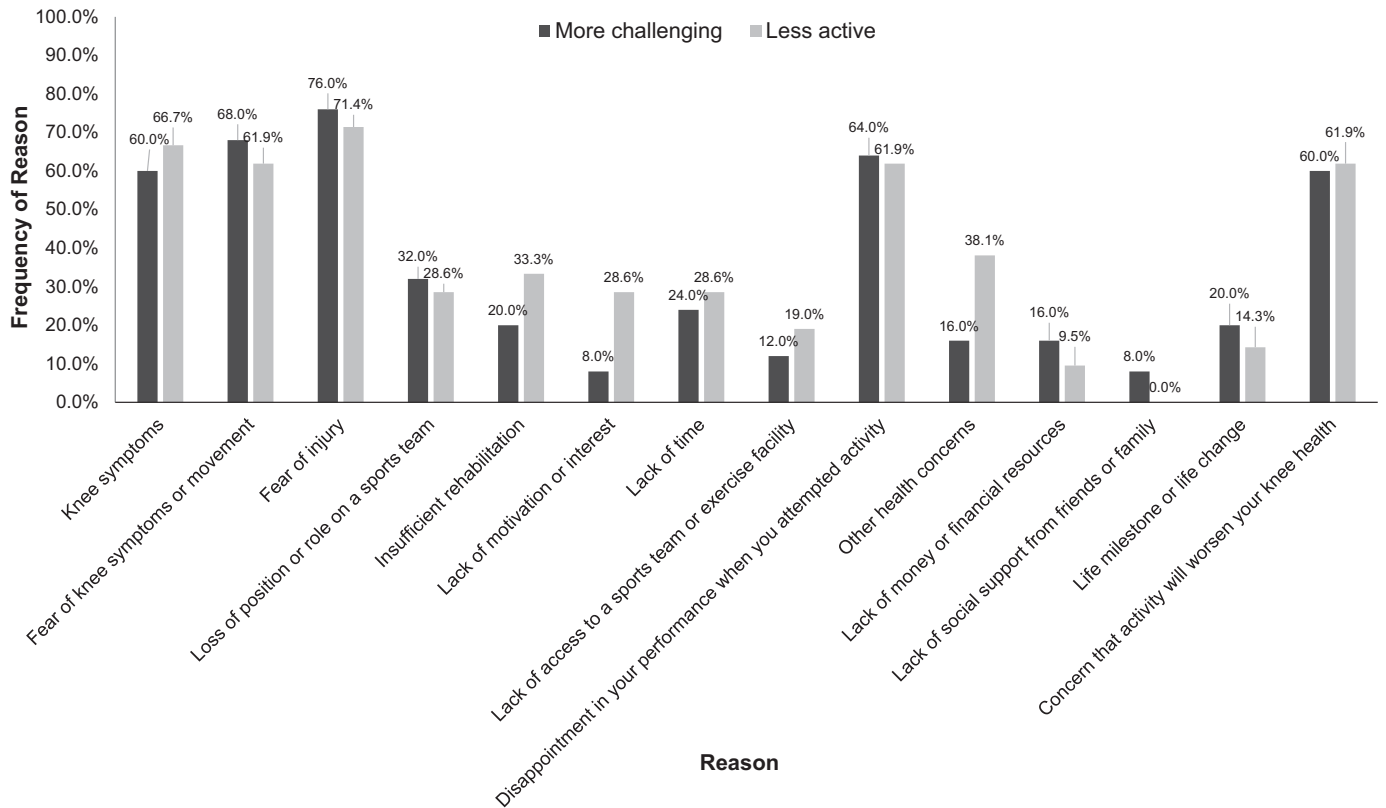


Figure 2. Frequency of reasons selected as any choice by participants in the more challenging and less active groups.

to evidence-based clinical interventions specifically designed to address barriers included in the ACL Reasons survey.

Several limitations should be considered when interpreting the findings of our study before implementation of the ACL Reasons survey. Currently, the ACL Reasons survey has only undergone face validation by a modest number of experts ($N = 7$) with an unintentional bias toward individuals with graduate degrees or advanced medical training. It is essential that future researchers attempt to establish the cultural validity of the survey among a larger cohort of experts who are diverse in ages, education levels, experiences with patients who have orthopaedic injuries, and primary languages spoken in the home, among other factors that may influence patients' perceptions of recovery from ACLR. The cross-sectional construct validity of the ACL Reasons survey was based on patient-reported outcome measures obtained from a modest number of patients ($N = 78$) recruited from only 2 sites. Future authors should evaluate the ACL Reasons survey across a more diverse sample and multiple time points during recovery to better characterize the value of this outcome measure. In the process of development and validation of the ACL Reasons survey, a double-barreled item³³ (ie, fear of knee symptoms or movement) was created and retained in the final version. This item was based on results from qualitative investigations, yet the structure of the item makes it challenging to understand if a given patient's primary concern is fear of knee symptoms or movement. Validation of the ACL Reasons survey should include an effort to split this item in order to minimize the confusion for patients and clarify the interpretation of patient responses by clinicians. The ACL Reasons survey was developed and distributed using an online survey platform, which might limit the ability of clinicians and researchers to adopt this

survey in their practice. Work is needed to validate the paper version of this survey to ensure broad access and adoption.

The ACL Reasons survey is an evidence-based, clinically feasible, and valid tool to assess patient-reported barriers to reengagement in preinjury levels of activity after ACLR. Nearly 62% of patients reported being less active or experiencing mental or physical challenges when engaging in activity after ACLR. Among these patients, knee symptoms, fear of knee symptoms or movement, and injury-related fear were the most important reasons for changes in their activity. Although further validation and longitudinal study is needed, the findings support the potential utility of the ACL Reasons survey as a structured qualitative tool to improve communication between the patient and clinician with the goal of enhancing patient-centered evaluation and intervention.

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SUPPLEMENTAL MATERIAL

Supplemental Material. Searchable summary of reviewer feedback on each iteration of the ACL Reasons.

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