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## Projected Utility of the Ready Set Return Application

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## INNOVATION HIGHLIGHT

# Projected Utility of the Ready Set Return Application

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- Introduction:** An application (app) that summarizes best practices may promote standardized care among clinicians treating patients during anterior cruciate ligament (ACL) rehabilitation. The purpose of this study was to test the prototype of the Ready Set Return (RSR) app to determine receptiveness for use in clinical practice.
- Methods:** Two mock patient cases were used to familiarize 19 physical therapists and athletic trainers with the RSR app. Then these participants provided feedback about the user experience, features, and content using Likert ratings and free-text fields through an online survey.
- Results:** Most participants (89%-95%) would recommend the RSR app to others and noted that the app would allow them to stay up to date with current practice. Thematic analysis of free-text responses indicated that the app was easy to navigate and that evidence-based progressions and clinical milestones were useful in clinical practice. Users suggested enhancements that included adding patient access and specific treatment options.
- Discussion:** Generalizable findings suggest that clinicians appreciated the details and images of specific tests and measures; automatic test scoring; and standardized benchmarks to progress care. Specific findings suggest the RSR app's summary of evidence-informed practice may help standardize care, specifically for patients undergoing rehabilitation after ACL reconstruction.
- Conclusion:** This subset of clinicians reacted positively to the prototype and felt that the RSR app would benefit their practice and patients. This feedback will guide the next iteration, advancing from a low-fidelity to high-fidelity prototype.
- Keywords:** usability testing, best practices, digital technology, mobile health, anterior cruciate ligament reconstruction
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Barriers to adopting best practices can result in suboptimal care.<sup>1</sup> The plethora of empirical evidence regarding best practices after anterior cruciate ligament (ACL) injury, combined with higher productivity expectations, makes contemporary practice difficult for clinicians. Not following evidence-informed care after ACL injury leads to unwarranted practice variation and can contribute to poor clinical outcomes.<sup>1</sup> Technology that summarizes evidence-informed practice guidelines may allow clinicians to integrate this evidence more readily into their clinical setting.

Clinicians are not following best practices after ACL reconstruction (ACLR).<sup>1</sup> Physical therapists (PT) reported inconsistencies in standardized practice after an ACLR. They also reported a gap in rehabilitation services, specifically when a PT discharges an athlete from formal physical therapy to, often months later, when the athlete attempts to return to sports (RTS).<sup>1</sup> Though annual incidence rates of 0.03% to 0.04% for an ACL rupture are fairly similar across the United States, Scandinavia, and Europe,<sup>2</sup> the general perception in the United States is that surgery is needed to RTS.<sup>3-5</sup> Approximately \$13000 is spent on overall health care use per ACL surgery, and the frequency of surgeries is increasing.<sup>6,7</sup> Only 55% of people who are injured RTS competitively,<sup>8</sup> and people who do RTS have a greater risk of re-injury.<sup>9,10</sup> These poor outcomes demonstrate the need to improve rehabilitation practices for patients after ACLR.

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Technology that summarizes best practices to guide clinical care after ACL injury is currently unavailable. We designed a prototype of the Ready Set Return mobile application (RSR app) to address clinicians' needs, including giving them access to standardized tests, clinical milestones to advance care, and user-friendly screens to facilitate communication among the rehabilitation team. The practicality of this RSR app and the ability to use technology to integrate evidence-informed care into clinical practice is innovative. The app contains 4 readiness levels, each with additional sublevels. Patients must meet the readiness levels before clinicians can advance them to the next level. Icons provide additional information, including progression criteria and information about patient-specific clinical milestones (Figure 1).

This manuscript describes clinicians' experience using the RSR app to guide ACL rehabilitation practice. Quantitative results were enriched with qualitative feedback. Having licensed clinicians trial the app and provide feedback about their experience is a crucial step in developing the RSR app.

## METHODS

We used purposeful sampling to recruit clinicians from various clinical settings who likely provide rehabilitation after ACLR. Practicing PTs and athletic trainers (ATs) in Maine who agreed to confidentiality were included in the study. PTs and ATs with no experience treating patients after ACLR were excluded. Nineteen PTs and ATs consented, enrolled, and participated in the study.

An app designer pre-populated the prototype with data from 2 mock patient cases. During data collection, the RSR app was accessed via a laptop through prototyping software (v2016, Figma, Inc, San Francisco, CA). For the first mock case, participants observed the researcher as they progressed the mock patient successfully through all levels: (1) Walk Without an Assistive Device, (2) Walk/Jog Progression, (3) Modified Sports, and (4) Return to Sports (Figure 1). During the second mock case, participants could navigate freely through the app, viewing clinical milestones, hyperlinks, icons for additional details, references to support the content, and a section with frequently asked questions. The doctor of physical therapy (DPT) student researchers recorded notes about participants' comments and questions during data collection using Research Electronic Data Capture

(REDCap; v11.0.3, Vanderbilt University, Nashville, TN).<sup>11,12</sup> Students verified these notes with each participant for accuracy.

Next, participants completed a demographic survey<sup>1</sup> and a user-feedback survey that included questions measured with a 5-point Likert scale (Table 1). Eight open-ended questions allowed users to explain their numerical responses, elaborate on features and usability, and suggest enhancements.

To minimize bias, DPT students collected data anonymously through REDCap. Means (SD) were calculated for continuous data, and frequency counts were calculated for each Likert question using Microsoft Office 365 Excel 2019 (v16.0 6742.2048, Microsoft Corporation, Redmond, WA). Two co-authors independently reviewed the free-text survey responses, coded data, and generated themes. These 2 authors then compared codes, reviewed themes, and agreed on common themes and subcategories.

This study was approved by the Institutional Review Board at the University of New England (IRB #0621-04).

## RESULTS

Of the total sample (N = 19), 12 were PTs, 4 were ATs, and 3 were licensed as both (PT/ATs). Participants' years of clinical experience was a mean [SD] of 3.2 [5.3] years for ATs, 6.4 [8.1] years for PTs, and 10.3 [8.1] years for PT/ATs. The number of patients treated by the participants after ACLR was about 3 per year for ATs, 4 per year for PTs, and 10 per year for PT/ATs. All ATs worked in an academic facility, whereas most PTs (n = 11) and all PT/ATs worked in an outpatient clinic or private practice.

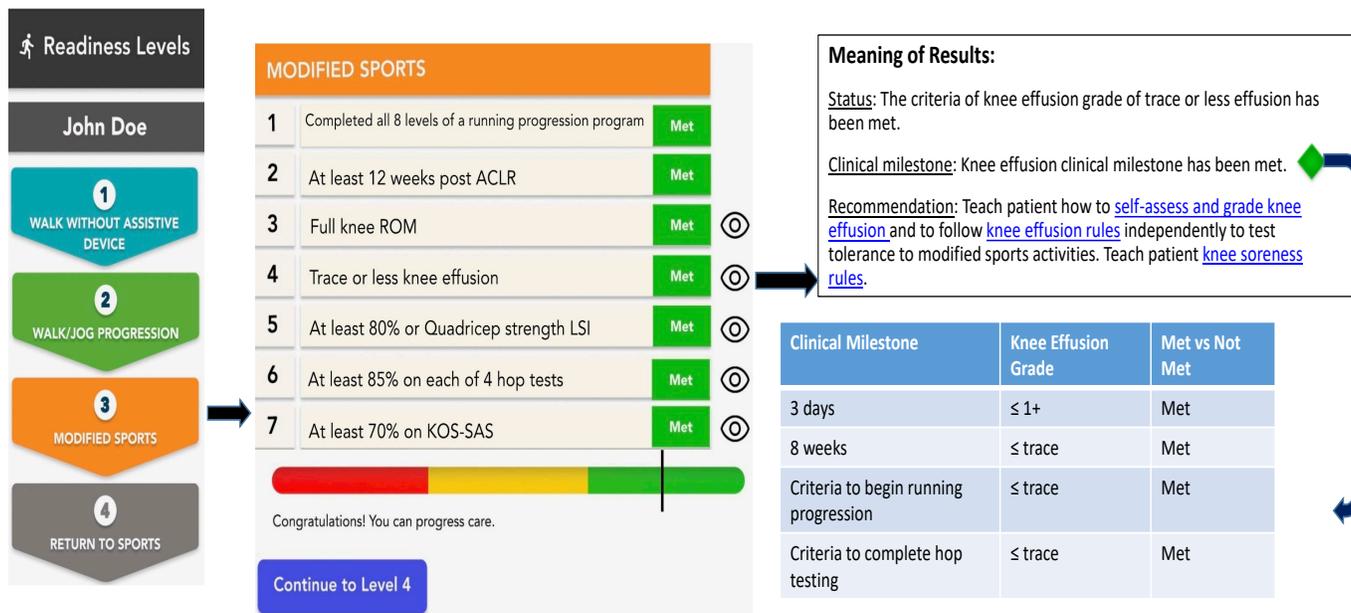
Results from participants' quantitative ratings are illustrated in Table 1. Two authors summarized qualitative responses in 4 main themes with subcategories and supporting exemplars.

### Navigation

**Intuitive** (n = 9): "easy, clear cut [*sic*] way to progress someone...helps you remember exactly what to do throughout the way"

**Logical flow** (n = 6): "able to tell which button would bring you to each link"

**Clear layout** (n = 6): "Things were highlighted well and easy to find"



**Figure 1.** Screenshots of Content in the RSR App. Mock patient, John Doe, has progressed through the first 2 levels of rehab after ACLR. Today, the clinician tested John to see if he could return to modified sports. The clinician clicked on Level 3 and entered data for each of the 7 sublevels. John Doe passed all criteria to return to modified sports. If the clinician clicks the eyeball icon, then a screen pops up to explain the meaning of the results. If the clinician clicks the diamond icon, then a screen pops up to illustrate the clinical milestone. ACLR, anterior cruciate ligament reconstruction; LSI, Limb Symmetry Index; KOS-SAS, Knee Outcome Survey Sports Activities Scale; ROM, range of motion; RSR, Ready Set Return.

**Table 1.** Likert Responses to User Experience

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I could easily find what I was looking for in the app.	63%	32%	0%	0%	5%
The quality of EBP content in the app will allow me stay up to date with my practice.	63%	27%	5%	0%	5%
Including time-based criteria will better inform my decisions to progress patients.	53%	37%	5%	0%	5%
Including criterion-based measures will better inform my decision to progress patients.	63%	32%	0%	0%	5%
I would recommend the RSR app.	74%	21%	0%	0%	5%

**Abbreviations:** EBP, evidence-based practice; RSR, Ready Set Return.

## Clinical utility

**Evidence-based progression** (n = 11): “the algorithm...information to track patients and ensure you have met all necessary criteria before moving to the next progression”

**Standardized tests** (n = 6): “access to the most up to date [sic] protocols...and this standardizes it for all of us” and “[Y]ou may forget to do something specific for a test, especially if you haven’t done it in a while”

**Patient education** (n = 5): “Patient being able to visualize which areas...to improve...to likely improve patient buy-in, compliance, and outcomes”

## Value

**Useful for all patients after ACLR** (n = 13): “I would use it every step of the way...it may be easy to overlook excessive effusion if strength numbers look good, which could lead to premature progression and possible injury”

**During transition points** (n = 3): “with ACLR patients who are looking to return to a sport”

**Specific users** (n = 6): “new graduates”, “rural clinicians”, “generalists who rarely treat patients post-ACL injury” and “clinicians wanting to keep current with ACL rehabilitation”

## Suggested Enhancement

**Patient access** (n = 6): provide patient access to their profile

**More details about treatment options** (n = 4): add more details about treatment options

## DISCUSSION

This study analyzed the usefulness and user receptiveness of the RSR app. Market fit was confirmed, as clinicians reported a high likelihood to use, satisfaction with content, the practicality and ease-of-use in clinical practice, and that they would recommend the app. Also, participants suggested that they would use the RSR app as an educational tool for patients.

The overall positive feedback supports that the RSR app can summarize evidence-informed practice and may effectively standardize care when clinicians

treat patients after ACLR. Previous findings indicated that following similar RTS timelines, and performance criteria, reduced re-injury rates in patients after ACLR by up to 84%.<sup>13</sup> Thus, using the RSR app to progress care after ACLR may reduce risk of re-injury.

Athletes younger than 25 years who RTS have the highest risk of re-injury after ACLR.<sup>14</sup> More than 50% of clinicians who were surveyed in this study stated they would use this app with every patient after ACLR across the continuum of care. This finding suggests that the RSR app could bridge the care gap when formal rehabilitation ends, but the athlete is not yet cleared to RTS.<sup>1,15</sup> Our survey responses also suggest that the RSR app addresses ATs’ concerns of not having the time, resources, and confidence to document patient care.<sup>16</sup> Further, if both PTs and ATs use the RSR app with their patients, expectations would be consistent during the transition from physical therapy services to clearance for RTS.

Fear of re-injury and lack of confidence after ACLR are primary reasons athletes choose not to RTS.<sup>17</sup> Participants indicated that they would use the RSR app to educate patients about where they are in their rehabilitation journey, such as when milestones have been achieved and to discuss future milestones. Because the RSR app illustrates progression guidelines and patient status, the app may improve clarity in communication and expectations. Also, an athlete’s self-efficacy and confidence may increase as they meet objective milestones in the RSR app.<sup>18</sup>

The limitations of this study include a small sample population, limited interoperability with the low-fidelity prototype, and the use of unvalidated surveys. Researchers pilot-tested the survey for understandability with faculty who publish survey data and DPT students across classes. One participant selected “strongly disagree” for each scaled response. However, the free-text responses were incongruent, as all responses to support their selection were positive. The suggested enhancements indicated areas to improve, including using the RSR app for patient education. Thus, some language will need to be modified to include lay terminology.

## CONCLUSIONS

A subset of clinicians reacted positively to the prototype and felt that the RSR app would benefit their practice and patients. This feedback will guide the next iteration, which will advance from a low-fidelity to a high-fidelity prototype. Although these preliminary findings are positive, further research is needed to determine whether the RSR app has utility in the clinical setting, is received positively by patients after ACLR, and, ultimately, can improve patient outcomes.

## Conflict of interest

Erin Hartigan has intellectual property (IP) in the form of copyrighted content for the prototype of the RSR application. Erin Hartigan and Nan Solomons have secured shared funding from the University of New England's Makerspace, Westbrook College of Health Professions, and Department of Physical Therapy to pay Bethany Rockney for freelance design.

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## REFERENCES

- Greenberg EM, Greenberg ET, Albaugh J, Storey E, Ganley TJ. Rehabilitation Practice patterns following anterior cruciate ligament reconstruction: a survey of physical therapists. *J Orthop Sports Phys Ther.* 2018;48(10):801-811. doi:10.2519/jospt.2018.8264
- Moses B, Orchard J, Orchard J. Systematic review: annual incidence of ACL injury and surgery in various populations. *Res Sports Med.* 2012;20(3-4):157-179. doi:10.1080/15438627.2012.680633
- Beynnon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, part 2. *Am J Sports Med.* 2005;33(11):1751-1767. doi:10.1177/0363546505279922
- Beynnon BD, Johnson RJ, Abate JA, Fleming BC, Nichols CE. Treatment of anterior cruciate ligament injuries, part I. *Am J Sports Med.* 2005;33(10):1579-1602. doi:10.1177/0363546505279913
- Marx RG, Jones EC, Angel M, Wickiewicz TL, Warren RF. Beliefs and attitudes of members of the American Academy of Orthopaedic Surgeons regarding the treatment of anterior cruciate ligament injury. *Arthroscopy.* 2003;19(7):762-770. doi:10.1016/s0749-8063(03)00398-0
- Mall NA, Chalmers PN, Moric M, et al. Incidence and trends of anterior cruciate ligament reconstruction in the United States. *Am J Sports Med.* 2014;42(10):2363-2370. doi:10.1177/0363546514542796
- Herzog MM, Marshall SW, Lund JL, Pate V, Spang JT. Cost of outpatient arthroscopic anterior cruciate ligament reconstruction among commercially insured patients in the United States, 2005-2013. *Orthop J Sports Med.* 2017;5(1):2325967116684776. doi:10.1177/2325967116684776
- Ardern CL, Taylor NF, Feller JA, Webster KE. Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. *Br J Sports Med.* 2014;48(21):1543-1552. doi:10.1136/bjsports-2013-093398
- Meredith SJ, Rauer T, Chmielewski TL, et al. Return to sport after anterior cruciate ligament injury: Panther Symposium ACL Injury Return to Sport Consensus Group. *Knee Surg Sports Traumatol Arthrosc.* 2020;28(8):2403-2414. doi:10.1007/s00167-020-06009-1
- Webster KE, Nagelli CV, Hewett TE, Feller JA. Factors associated with psychological readiness to return to sport after anterior cruciate ligament reconstruction surgery. *Am J Sports Med.* 2018;46(7):1545-1550. doi:10.1177/0363546518773757
- Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform.* 2019;95:103208. doi:10.1016/j.jbi.2019.103208
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform.* 2009;42(2):377-381. doi:10.1016/j.jbi.2008.08.010
- Grindem H, Snyder-Mackler L, Moksnes H, Engebretsen L, Risberg MA. Simple decision rules can reduce reinjury risk by 84% after ACL reconstruction: the Delaware-Oslo ACL cohort study. *Br J Sports Med.* 2016;50(13):804-808. doi:10.1136/bjsports-2016-096031
- Wiggins AJ, Grandhi RK, Schneider DK, Stanfield D, Webster KE, Myer GD. Risk of secondary injury in younger athletes after anterior cruciate ligament reconstruction: a systematic review and meta-analysis. *Am J Sports Med.* 2016;44(7):1861-1876. doi:10.1177/0363546515621554
- de Mille P, Osmak J. Performance: bridging the gap after acl surgery. *Curr Rev Musculoskelet Med.* 2017;10(3):297-306. doi:10.1007/s12178-017-9419-2
- Bacon CEW, Eppelheimer BL, Kasamatsu TM, Lam KC, Nottingham SL. Athletic trainers' perceptions of and barriers to patient care documentation: a report from the Athletic Training Practice-Based Research Network. *J Athl Train.* 2017;52(7):667-675. doi:10.4085/1062-6050-52.3.15
- Ardern CL, Webster KE, Taylor NF, Feller JA. Return to the preinjury level of competitive sport after anterior cruciate ligament reconstruction surgery: two-thirds of patients have not returned by 12 months after surgery. *Am J Sports Med.* 2011;39(3):538-543. doi:10.1177/0363546510384798
- Pekmezi D, Jennings E, Marcus BH. Evaluating and enhancing self-efficacy for physical activity. *ACSMs Health Fit J.* 2009;13(2):16-21. doi:10.1249/FIT.0b013e3181996571