

Original Research

Physical Therapists' Use of Psychological Skills Training in Rehabilitation Following Traumatic Knee Injury: An Online Survey Study

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Background

Rehabilitation following traumatic knee injury often focuses primarily on physical aspects. Lack of knowledge of psychological factors and appropriate strategies may be a barrier to meeting treatment recommendations to address these factors.

Purpose

The aim of this study was to investigate whether, and to what extent, Scandinavian physical therapists address psychological factors in treatment of physically active people with traumatic knee injury.

Study Design

Cross-sectional online survey study.

Methods

This 32-item study-specific online survey examined physical therapists' use of goal-setting, imagery, and arousal regulation to address psychological factors during rehabilitation following traumatic knee injury.

Results

Results from n=143 physical therapists indicate that they consider it very important to use goal-setting (median 4 [IQR 1]), imagery (median 4 [IQR 1]), and stress management (median 4 [IQR 1]) during rehabilitation on a scale of 1 (lowest) to 5 (highest). Goal-setting was used by n=143 (100%); imagery by n=67 (47%), and arousal regulation by 76 (53%). Lack of knowledge was the most commonly cited reason for not using imagery (n=61; 43%) and arousal regulation (n=55; 38%). Participants rated workshops, courses, or formal education as the most useful methods of learning to use psychological skills training in clinical work.

Conclusion

Goal-setting is commonly used by Scandinavian physical therapists. However, only approximately half of participants report using imagery and/or arousal regulation in knee

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injury rehabilitation. This may indicate that best-evidence recommendations for treatment are not being met. Future research should explore methods for providing education and practical strategies for encouraging clinical use of psychological interventions.

Level of Evidence

3

INTRODUCTION

Following traumatic knee injury, treatment recommendations include thorough guidelines of phase-based physical rehabilitation with focus on restoring function of the knee and surrounding structures.¹⁻³ Recent research has shown that psychological factors are also important for ensuring return to sport,⁴⁻⁶ and existing recommendations include addressing these psychological aspects.¹⁻³ However, the degree of detail is scarce in comparison with physical rehabilitation, with limited descriptions of psychological interventions. The observed associations between psychological factors and failure to return to sport^{7,8} indicate that rehabilitation may not be taking full advantage of psychological interventions to prepare people both physically and psychologically for return to sport.

Suggested methods of improving psychological aspects related to rehabilitation include general support and encouragement. Specific structured psychological skills training interventions are evidence-based methods that aim to improve enjoyment, motivation, and performance, for example. Psychological factors have been shown to be important for both return to activity outcomes, as well as risk of reinjury,⁹ indicating a need for targeted strategies. Goal-setting, arousal regulation, and imagery are examples of psychological skills training interventions as methods of improving psychological factors following traumatic knee injury.^{2,3} Research indicates that these interventions are effective for improving psychosocial¹⁰ and performance¹¹ outcomes. However, intervention studies on injured populations are less prevalent, and show varying degrees of efficacy.¹² Physical therapists (PTs) describe a lack of psychological strategies in qualitative interviews,^{13,14} and research suggests persisting psychological problems,^{8,15} which could indicate that interventions are insufficiently implemented.

Clinicians and researchers may need a better understanding of current clinical methods and perceptions on the use of psychological interventions during rehabilitation. This may help to address the identified knowledge gap regarding methods of influencing physical and psychological factors to aid in reaching successful rehabilitation outcomes. Research is sparse, with only one recent study surveying physical therapists (PT's) and physical therapy (PT) students regarding views of and education in psychological interventions during rehabilitation.¹⁶ Addressing this gap could lead to further development of strategies to ensure that both physical and psychological readiness to return to sport are addressed. The aim of this study was to investigate whether, and to what extent, Scandinavian physi-

cal therapists address psychological factors in treatment of physically active people with traumatic knee injury.

METHODS

DESIGN AND PARTICIPANTS

The study used a cross-sectional online survey design reported according to the Checklist for Reporting of Survey Studies (CROSS) Guidelines.¹⁷ Data were collected using Survey and Report (Artisan Global Media), hosted by Lund University.

Clinically active PTs in Denmark, Norway, and Sweden who regularly treated physically active people with traumatic knee injury (at least five per year on average to ensure data on commonly used strategies) were eligible for inclusion. PTs involved in the MOTIFS study, a randomized controlled trial coordinated by the first author which integrates imagery into rehabilitation training,¹⁸ were excluded.

PROCEDURES

SURVEY DEVELOPMENT

The study-specific survey was developed in English by the authors, then translated and cross-culturally adapted by experts with native-language proficiency in Swedish, Danish, and Norwegian, respectively. Translation was aided by the free online artificial intelligence translation tool DeepL Translator,¹⁹ checked for consistency by the authors and pilot-tested twice on third-party (n=7) people familiar with PT and research. An overview of the survey (not including demographic questions) is provided in Table 1. The full survey, including answer alternatives, is available in Appendix 1.

Based on literature searches and expert discussion on current recommendations and common clinical practice regarding use of psychological skills training, the domains "Specific Understanding of Psychological Skills Training" and "Need/Desire for Further Education" were identified. Within these, three psychological skills training principles were identified as important to return to sport or activity outcomes: goal-setting (short- or long-term rehabilitation goals), imagery (mental and/or physical simulation), and arousal regulation (regulation of physical and psychological stress).^{16,20} Each of these were further categorized into the constructs "Use," "Confidence," "Importance." A "Target Group" was also included, inspired by previous research.^{21, 22} Included in the "Use" construct are questions regarding direct or indirect involvement of other activity-specific actors such as coaches in treatment strategies.

Thirty-two items are included in the survey, with between 20 and 30 items possible based on conditional logic. Nine items record demographic and background information, including location, experience, and education. Four additional items collect consent and confirm exclusion criteria (if relevant). The Swedish version includes an extra exclusion criterion regarding involvement in the MOTIFS study.¹⁸

Thirty items are single- or multiple-choice, in which participants answer according to one or several alternatives, respectively. Items on the constructs Confidence and Importance include a 1 (low) to 5 (high) Likert-type scale (i.e. 1 [not confident at all] – 5 [extremely confident]). The Use and Target Group constructs include example alternatives (i.e. “once in the beginning,” “once per phase,” etc.). Item 31 is a matrix, in which six alternatives (brochures, popular science materials, academic articles, workshops, professional courses, and formal education) are rated on their perceived utility, and item 32 is optional, allowing free-text suggestions.

DATA COLLECTION

Participants were recruited according to a convenience and snowball sampling method, distributed via personal contacts and social media using a language-specific survey link, in which responses from one computer were restricted for 10 minutes after entering the survey link.

DATA ANALYSIS

Due to the exploratory nature and lack of studies regarding this topic, no sample size was defined. Demographic and background variables were presented on a group level, exported from the data collection software into the IBM SPSS (v29) statistical software package. Results are presented as median (IQR) and/or number (percent) to present the full context of the results and prevalence for each answer alternative. Free-text responses were translated to English using the DeepL Translate tool,¹⁹ checked by native speakers of each language, and categorized based on similarity. Responses to all questions were required, so no data was missing.

ETHICAL CONSIDERATIONS

All participants received written information, and informed consent was collected. All data was stored on a secure server at Lund University in Sweden. Ethical approval was not required according to the Danish, Norwegian, and Swedish ethical review regulations, as responses are anonymized and do not include any sensitive data.

RESULTS

DEMOGRAPHICS

Responses were collected between September 2023 and January 2024 (Table 2) from n=150 PTs, n=143 of whom were eligible for inclusion (participant flow diagram in Fig-

ure 1). Median age of participants was 41-50 years, with median experience greater than 11 years.

RETURN TO ACTIVITY TESTING

Responses indicate that n=142 (99%) use physical return to sport testing, the most common of which are strength and functional hop measures (Table 3). Psychological measures are used by n=135 (94%), most commonly discussions with the patient and behavior observation. Structured psychological follow-up strategies are reported as being used by n=132 (92%), most commonly patient education.

PSYCHOLOGICAL SKILLS TRAINING USE

GOAL-SETTING

Goal-setting was used by n=143 (100%). Sixty-seven (47%) use goal-setting once per phase; n=117 (82%) report encouraging use through direct contact with key people (Figure 2). Importance (median 4 [IQR 1]), and confidence (median 4 [IQR 1]) are shown in Figure 3. Goal-setting use with different patient groups is shown in Figure 4. Free-text responses included n=1 clarifying special attention to non-physically active people who require physical training for their rehabilitation.

IMAGERY

Imagery was used by n=67 (47%). Imagery was most frequently reported as being used once per phase (n=33; 23%); lack of knowledge was the most frequently reported reason for non-use (n=61; 43%), and n=50 (35%) reported encouraging use through direct contact with key people (Figure 2). Importance (median 4 [IQR 1]), and confidence (median 3 [IQR 1]) is shown in Figure 3. Figure 4 shows use of imagery with different patient groups.

AROUSAL REGULATION

Arousal regulation was used by n=76 (53%); n=33 (23%) reported use every or every other session; lack of knowledge was the most frequently reported reason for non-use (n=55; 38%), and n=60 (42%) report encouraging use through direct contact with key people (Figure 2). Importance (median 4 [IQR 1]), and confidence (median 3 [IQR 1]) are shown in Figure 3. Arousal regulation use with different patient groups is presented in Figure 4.

NEED/DESIRE FOR FURTHER EDUCATION

Perceived usefulness of educational strategies is presented in Figure 5. Professional courses were rated as having greatest perceived usefulness (median 4, IQR 1).

DISCUSSION

Results of this study suggest that goal-setting is a commonly used psychological strategy by Scandinavian PTs in the treatment of patients with knee injury. Use of imagery

Table 1. Overview of the domain-specific questions from the survey

Item		Construct
Use of Return to Sport/Activity Testing		
10	Which physical measures do you use to determine readiness to return to sport or activity?	Return-to-Activity Testing
11	*Which psychological measures do you use to determine readiness to return to sport or activity?	
12	*How do you change your practice based on the results of these [psychological] measures (i.e. follow-up on results from ACL-RSI, KOOS, etc.)?	
Domain 1 - Understanding of Psychological Skills Training		
Principle: Goal-setting		
13	How often do you use goal-setting with patients with knee injury?	Use
14	*If you do not use goal-setting , why not (select all that apply)?	Use
15	How confident are you in your ability to use goal-setting with a patient, on a scale from 1 (Not confident at all) to 5 (Extremely confident)?	Confidence
16	How important do you consider goal-setting in rehabilitation, on a scale from 1 (Not important at all) to 5 (Extremely important)?	Importance
17	*With which patient groups do you use goal-setting (select all that apply)?	Target Group
18	When using goal-setting , do you involve key people in the patient's life (select all that apply)?	Use
Principle: Imagery		
19	How often do you use imagery/visualization with patients with knee injury?	Use
20	*If you do not use imagery/visualization , why not (select all that apply)?	Use
21	How confident are you in your ability to use imagery/visualization with a patient, on a scale from 1 (Not confident at all) to 5 (Extremely confident)?	Confidence
22	How important do you consider imagery/visualization in rehabilitation, on a scale from 1 (Not important at all) to 5 (Extremely important)?	Importance
23	With which patient groups do you use imagery/visualization (select all that apply)?	Target Group
24	When using imagery/visualization , do you involve key people in the patient's life (select all that apply)?	Use
Principle: Arousal Regulation		
25	How often do you use techniques to regulate stress with patients with knee injury?	Use
26	*If you do not use techniques to regulate stress , why not (select all that apply)?	Use
27	How confident are you in your ability to use techniques to regulate stress with a patient, on a scale from 1 (Not confident at all) to 5 (Extremely confident)?	Confidence
28	How important do you consider techniques to regulate stress in rehabilitation, on a scale from 1 (Not important at all) to 5 (Extremely important)?	Importance
29	*With which patient groups do you use techniques to regulate stress (select all that apply)?	Target Group
30	When using techniques to regulate stress , do you involve key people in the patient's life (select all that apply)?	Use
Domain 2 - Need/Desire for Further Education		
31	How useful would the following methods be for learning how to help patients with knee injury deal with psychological aspects on a scale from 1 (Not useful at all) to 5 (Extremely useful)	Education
32	*If you have other suggestions for effective methods of learning more about psychological factors in rehabilitation, please write them below	Education

*Includes option for free-text specification of "other" answer alternative.

Bold text included in final survey to accentuate the principle of interest in each question.

and arousal regulation was reported by only approximately half of respondents, despite perceptions of these strategies as being very important in helping people with psychological factors during rehabilitation. Relatively few PTs report directly involving key people, instead encouraging the patient to initiate this contact. The most frequently reported reason for not using imagery and arousal regulation

strategies was lack of knowledge. To address this gap, respondents indicate that practical workshops and continuing professional development courses would be useful tools.

Literature has shown that psychological factors are important for return-to-activity outcomes,^{4,23} and current recommendations include increasing focus on these factors

Table 2. Participant Demographics

Demographic Variable	n (%)
Gender	
Male	62 (43)
Female	81 (57)
Age (years)	
20-30	20 (14)
31-40	44 (31)
41-50	42 (29)
51-60	28 (20)
61+	9 (6)
Experience (years)	
<5	24 (17)
5-10	29 (20)
>11	90 (63)
Highest level of education*	
Bachelor's	75 (52)
Master's	49 (34)
PhD	12 (8)
Sector	
Public	35 (24)
Private	84 (59)
Both Public and Private	24 (17)

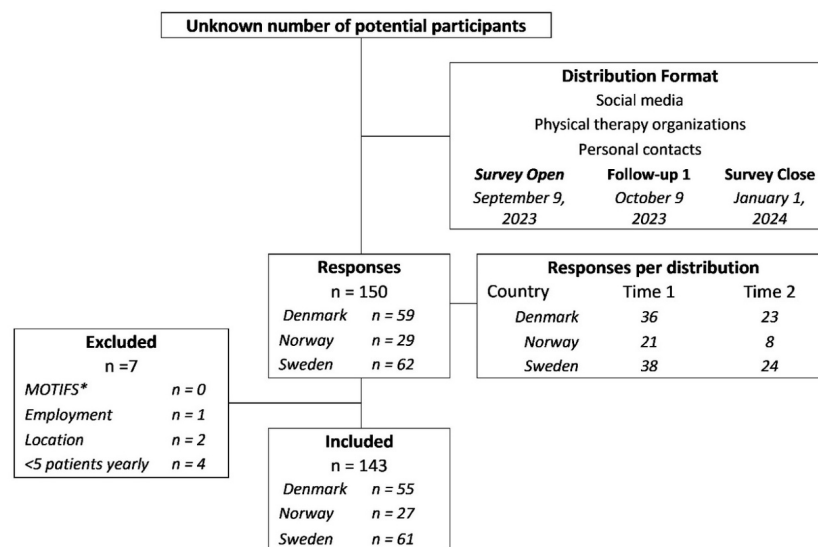
* Free-text responses indicate n=5 with specialist education in sports physical therapy, n=1 with extra sports medicine courses, and n=1 unspecified other
n = number of responses; % = percentage of total responses

during rehabilitation.^{2,3} However, results of this study confirm qualitative research results indicating a general lack of

knowledge on what constitutes psychological measures and interventions.^{13,14} The vast majority of PTs indicated that they use psychological return-to-activity measures (most frequently discussion with the patient and observation of behavior). Previous research suggests, however, that PTs have insufficient knowledge of what questions to ask to gain insight into the sources of patients' psychological difficulties.¹⁴ This could potentially explain the current results indicating follow-up strategies of educating patients and reducing physical training load rather than targeted psychological interventions.

The fact that PTs indicate a need and/or desire for practical education in the form of workshops or courses indicates a continued dualistic perspective in rehabilitation, in which physical and psychological factors are separate, rather than adopting a holistic perspective. Lack of proper education in psychological interventions despite considerable evidence of their importance indicates that physical therapy culture has not adopted the necessary holistic approach which has long been advocated. It is therefore important for researchers and practitioners to focus on increasing the knowledge base in order to develop methods of delivering structured and evidence-based interventions in the clinic.

Goal-setting seems to be a well-used intervention by Scandinavian PTs, as all respondents included in this survey indicate use. However, due to the formulation of the questions, it is difficult to know how this was implemented in practice. Previous research has indicated that goal-setting occurs mainly through the PT informing of goals,^{13,14} rather than dynamic and learning-based goals as outlined in current goal-setting theory.²⁴ This is an important distinction to make, as inappropriate goal-setting may have detrimental effects, including inhibition of proper learning,



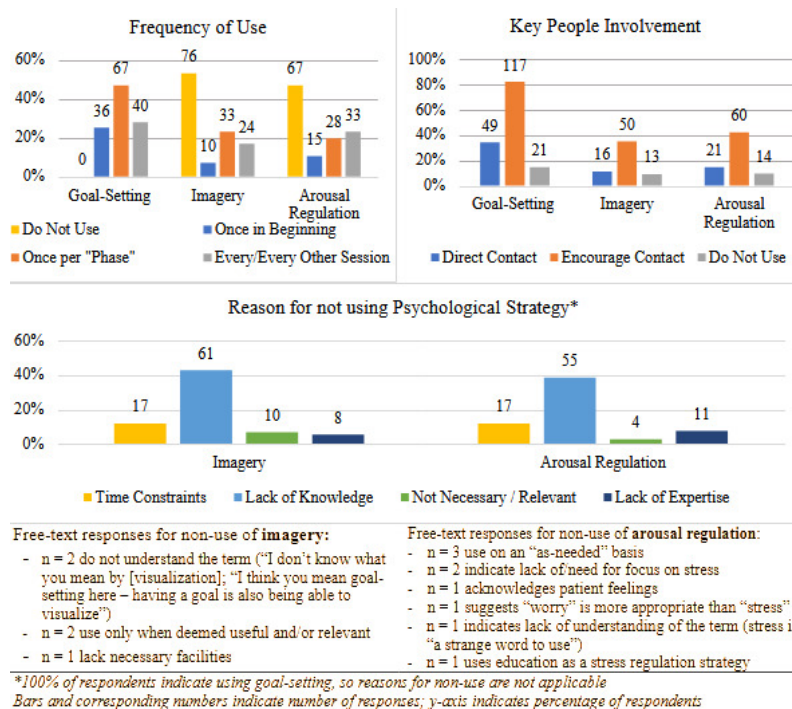
*Exclusion criteria question posed only to Swedish physical therapists to exclude those involved in a study coordinated by the first author
Employment = Not employed as a physical therapist at time of response; Location = employed as a physical therapist in a country other than Denmark, Norway, and/or Sweden at time of response; <5 patients yearly = self-reported average of fewer than 5 patients with traumatic knee injury treated annually

Figure 1. Participant Flow Chart

Table 3. Return to activity testing.

	# (%)
Use physical return to activity measures	142 (99)
Strength	128 (90)
Functional Hop ability	132 (92)
Movement Quality	105 (73)
Agility	80 (56)
Use psychological return-to-activity measures	135 (94)
Psychological aspects (i.e. perceived knee confidence [KOOS] or function [Knee Outcome Survey])	59 (41)
Psychological state (i.e. ACL-RSI)	49 (34)
Patient discussion	127 (89)
Observation of behavior	120 (84)
Questionnaires not specifically mentioned in survey (i.e. symptoms or function) [Free-text]	4 (3)
Patient discussion (i.e. needs) and/or evaluation [Free-text]	2 (1)
Specific interventions (i.e. CBT or ACT) [Free-text]	2 (1)
Use Psychological follow-up strategy	132 (92)
Change training load	107 (75)
Education	126 (93)
Motivational strategies	113 (79)
Breathing exercises	25 (17)
Refer elsewhere (e.g. psychologist)	52 (36)
No structured follow-up	3 (2)
Exposure Therapy [Free-text]	4 (3)
Further individual discussion [Free-text]	1 (1)
Include patient in exercise choice (i.e. from a "menu" of exercises) [Free-text]	1 (1)

= number of responses; % = percentage of responses from total sample; KOOS = Knee Injury and Osteoarthritis Outcome Score; ACL-RSI = anterior cruciate ligament return to sport after injury scale; [Free-text] = responses provided in free-text form; CBT = Cognitive Behavioral Therapy; ACT = Acceptance and Commitment Therapy

**Figure 2. Frequency of use, strategies to involve key people, and, where appropriate, reasons for non-use of goal-setting, imagery, and arousal regulation.**

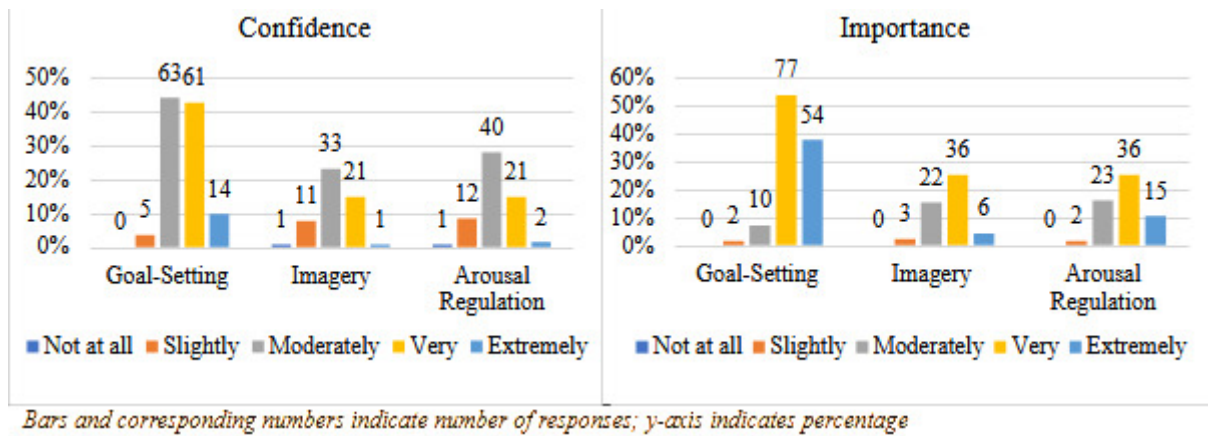


Figure 3. Perceived confidence and importance of clinical use of goal-setting, imagery, and arousal regulation

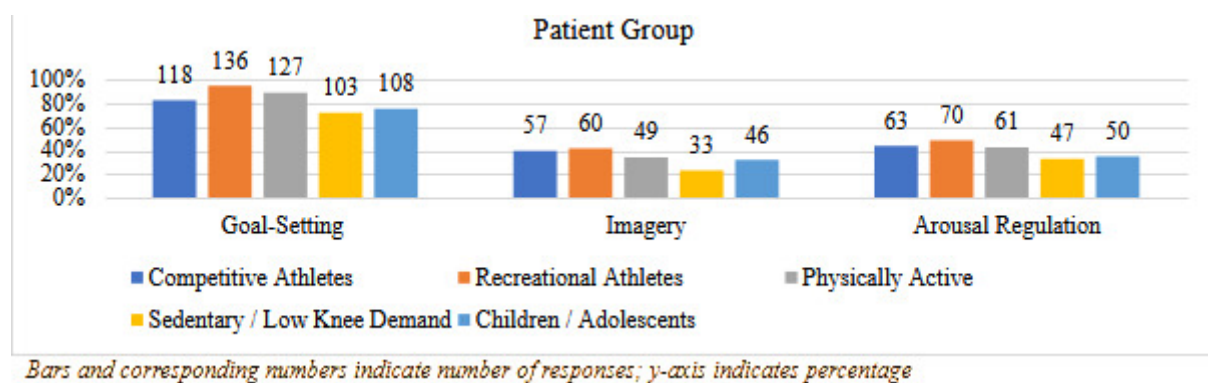


Figure 4. Use of goal-setting, imagery, and arousal regulation with different patient groups.

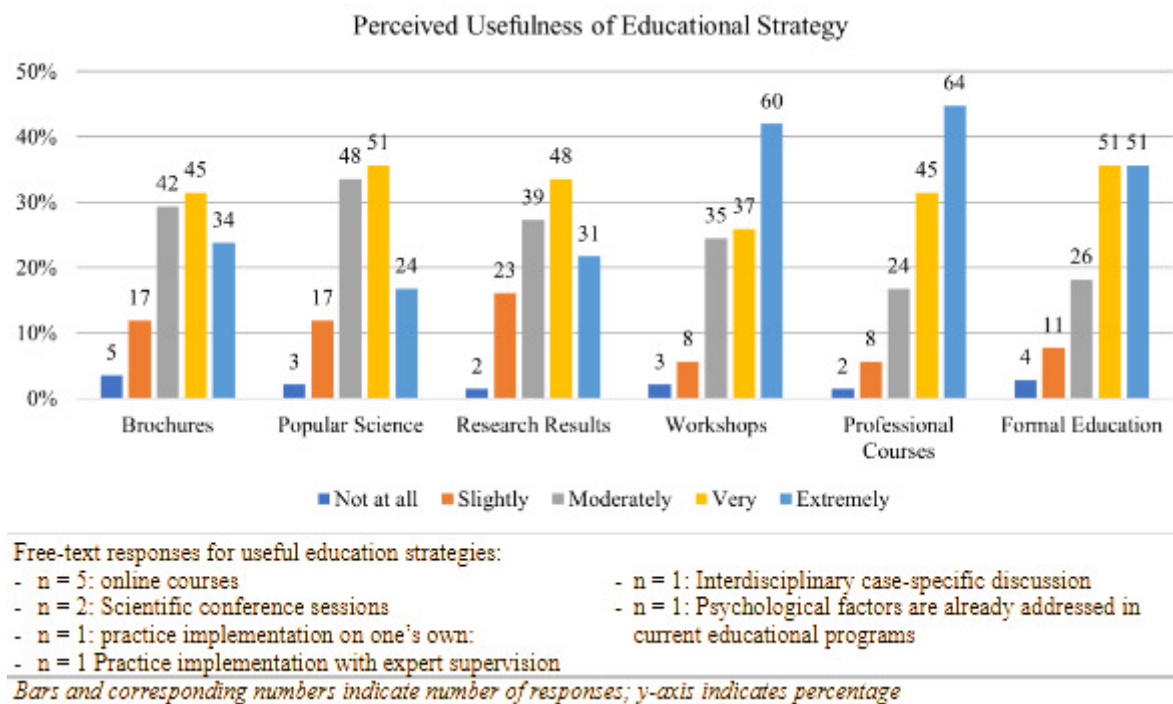


Figure 5. Perceived usefulness of educational strategies to inform clinical use of psychological skills training.

misrepresenting efforts (i.e. lying about compliance), and/or skipping steps to stay on schedule.²⁴ In sport injury rehabilitation, it is therefore imperative that PTs are able to deliver a goal-setting intervention which follows convention and has a positive psychological effect. Future research should explore intervention delivery methods to design pragmatic instructional guides for clinicians.

Imagery interventions were used relatively infrequently, and several free text responses indicated confusion regarding terminology, including one respondent confusing imagery with goal-setting. Based on the results, one can only speculate, but it is possible that PTs are mis- or uninformed regarding imagery. Modern imagery practice has moved beyond quietly and statically sitting while imagining execution,²⁵ instead incorporating movement to create physical and psychological realism.^{26,27} Clinicians and researchers should further explore using imagery to prepare for return-to-activity in terms of real-world challenges such as dual-task demands²⁸ and pain,²⁹ for example. Previous research on injured populations shows that imagery training may be beneficial in terms of pain, muscle activation, strength, performance³⁰ and self-reported knee function.³¹ Additionally, imagery interventions have been shown to reduce stress hormones in people with knee injury,³² indicating potential for use as an arousal regulation intervention.

Arousal regulation includes reducing, maintaining, or enhancing physical and/or psychological states to fit the needs of a goal-directed situation.³³ This includes controlling one's stress response to match the situation.³⁴ for example by calming down or "pumping up." However, several respondents suggested that "stress" is an inappropriate word choice, indicating a problematic misunderstanding of the stressful nature of sport injury and subsequent rehabilitation. Psychological stress is recognized as both a potential cause and an effect of sport injury,^{35,36} and PTs indicate stress as a pressing issue with patients.¹⁴ In the context of sport injury rehabilitation, the goal is often to return to some form of activity, so it is essential that the person can control their levels of stress and arousal to handle the requirements upon return to activity. This is supported by calls for improving dual-task motor control during physical performance with sport-specific external stimuli.^{37,38}

Social support and engagement are important aspects to sport injury rehabilitation,⁴ especially in implementing psychological skills training interventions. PTs foster self-determined motivation by relating to patients,^{39,40} discussing proper goal-setting, individualizing imagery, and encouraging arousal regulation techniques. Outside the clinic, this could also include discussing these supplements to rehabilitation methods with key people such as coaches or training partners. Results of this study indicate that very few PTs actively initiate contact with people key to their activity, instead encouraging the person to take the initiative themselves. This therefore represents a missed opportunity to take a truly holistic approach to well-being and rehabilitation. Future research should also examine other key people such as friends and family, as social support from all areas of life is important.

The rehabilitation literature has identified psychological factors as important for rehabilitation outcomes,^{4,5} and called for increased focus on these factors during rehabilitation,² but suggests that these are likely not addressed to an appropriate extent.^{13,14} Results of this study indicate that psychological interventions are not often used, and physical therapists express a desire for education in implementation methods. Following injury, unpleasant feelings are natural and frequent and difficult to get rid of, PTs should help athletes commit to good rehabilitation behaviors and formulate goals during and after the injury period. Sport psychology approaches such as mindfulness and acceptance can help athletes accept (unpleasant as well as pleasant) inner experiences, engage in the present moment and commit to valued behaviors.⁴¹ Additionally, proper use of imagery interventions may be a pragmatic clinical tool for preparing people for return to the demands of their activity by creating more meaningful and relevant training. Providing holistic rehabilitation interventions to meet recommendations for treatment of people with knee injury may be an easily implemented method of encouraging more physically and psychologically sound rehabilitation.

STRENGTHS AND LIMITATIONS

Strengths of this study include the use of a specifically designed and cross-culturally adapted survey to explore PTs' perspectives on their own use of psychological skills training, exploration of which has been lacking in the literature despite current recommendations. This provides highly relevant information for both clinically active PTs as well as researchers, as it allows for insight into practical use of underrepresented psychological training. Additionally, results provide information which can inform future pragmatic implementation. The survey was developed with feedback from, and pilot tested on, clinically active PTs and researchers, which increases the reliability and relevance of the questions posed, though measurement properties have not been evaluated. Including sports psychologists in the development also allows for a more holistic approach to this interdisciplinary study.

One potential limitation is that the invitation informed participants that the survey aimed to examine psychological skills training use in rehabilitation of knee injury, possibly dissuading those who do not address psychological factors, potentially limiting generalizability. There may also be a sampling bias limiting generalizability, as the contacted groups may not represent the general PT population. Additionally, the size of the potential participant pool is unknown, given that targeting strategies included several social media platforms, increasing likelihood of multiple exposures. It was not possible to identify whether participants registered more than one response, but this is unlikely due to the extent of the survey. The multiple-choice questions may limit validity of responses; for example, options for use of psychological strategies for determining readiness to return to activity include "motivational strategies," resulting in difficulty in drawing conclusions regarding clinical applications.

CONCLUSIONS

While goal-setting use was reported by all PTs, a persistent underuse of other aspects of psychological skills training in rehabilitation following traumatic knee injury, suggesting that best-practice recommendations are not being followed. Future efforts need to focus on providing proper education in holistic and person-centered rehabilitation paradigms to address physical, social, and psychological aspects of sport injury. This should include information on identifying psychological factors, proper methods of communication to address these factors, and methods for clinicians to administer structured psychological interventions.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available upon reasonable request.

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REFERENCES

1. Culvenor AG, Girdwood MA, Juhl CB, et al. Rehabilitation after anterior cruciate ligament and meniscal injuries: a best-evidence synthesis of systematic reviews for the OPTIKNEE consensus. *Br J Sports Med.* 2022. doi:[10.1136/bjsports-2022-105495](https://doi.org/10.1136/bjsports-2022-105495)
2. Filbay SR, Grindem H. Evidence-based recommendations for the management of anterior cruciate ligament (ACL) rupture. *Best Pract Res Clin Rheumatol.* 2019;33(1):33-47. doi:[10.1016/j.berh.2019.01.018](https://doi.org/10.1016/j.berh.2019.01.018)
3. van Melick N, van Cingel REH, Brooijmans F, et al. Evidence-based clinical practice update: Practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. *Br J Sports Med.* 2016;50(24):1506-1515. doi:[10.1136/bjsports-2015-095898](https://doi.org/10.1136/bjsports-2015-095898)
4. Truong LK, Mosewich AD, Holt CJ, et al. Psychological, social and contextual factors across recovery stages following a sport-related knee injury: A scoping review. *Br J Sports Med.* 2020;54:1149-1156. doi:[10.1136/bjsports-2019-101206](https://doi.org/10.1136/bjsports-2019-101206)
5. McPherson AL, Feller JA, Hewett TE, et al. Psychological readiness to return to sport is associated with second anterior cruciate ligament injuries. *Am J Sports Med.* 2019;47(4):857-862. doi:[10.1177/0363546518825258](https://doi.org/10.1177/0363546518825258)
6. Zarzycki R, Failla M, Capin JJ, et al. Psychological readiness to return to sport is associated with knee kinematic asymmetry during gait following anterior cruciate ligament reconstruction. *J Orthop Sports Phys Ther.* 2018;48(12):968-973. doi:[10.2519/jospt.2018.8084](https://doi.org/10.2519/jospt.2018.8084)
7. Suzuki M, Ishida T, Matsumoto H, et al. Association of psychological readiness to return to sports with subjective level of return at 12 months after ACL reconstruction. *Orthop J Sports Med.* 2023;11(9):23259671231195030. doi:[10.1177/23259671231195030](https://doi.org/10.1177/23259671231195030)
8. Toale JP, Hurley ET, Hughes AJ, et al. The majority of athletes fail to return to play following anterior cruciate ligament reconstruction due to reasons other than the operated knee. *Knee Surg Sports Traumatol Arthrosc.* 2021;29(11):3877-3882. doi:[10.1007/s00167-020-06407-5](https://doi.org/10.1007/s00167-020-06407-5)
9. Caumeil B, Laboute E, Verhaeghe E, et al. Reinjury anxiety and return to sport after anterior cruciate ligament reconstruction: A cluster analysis and prospective study among 162 athletes. *Am J Sports Med.* 2024;52(5):1189-1198. doi:[10.1177/03635465241234887](https://doi.org/10.1177/03635465241234887)
10. Gennarelli SM, Brown SM, Mulcahey MK. Psychosocial interventions help facilitate recovery following musculoskeletal sports injuries: A systematic review. *Phys Sportsmed.* 2020;48(4):370-377. doi:[10.1080/00913847.2020.1744486](https://doi.org/10.1080/00913847.2020.1744486)
11. Slimani M, Bragazzi NL, Tod D, et al. Do cognitive training strategies improve motor and positive psychological skills development in soccer players? Insights from a systematic review. *J Sports Sci.* 2016;34(24):2338-2349. doi:[10.1080/02640414.2016.1254809](https://doi.org/10.1080/02640414.2016.1254809)
12. Coronado RA, Bley JA, Huston LJ, et al. Composite psychosocial risk based on the fear avoidance model in patients undergoing anterior cruciate ligament reconstruction: Cluster-based analysis. *Phys Ther Sport.* 2021;50:217-225. doi:[10.1016/j.pts.2021.05.012](https://doi.org/10.1016/j.pts.2021.05.012)
13. Cederström N, Ageberg E, Granér S. Lived experiences of physical therapists treating traumatic knee injury using integrated psychological training (MOTIFS): a qualitative interview study. *Physiother Theory Pract.* 2024;40(7):1522-1536. doi:[10.1080/09593985.2023.2176729](https://doi.org/10.1080/09593985.2023.2176729)
14. Piussi R, Krupic F, Senorski C, et al. Psychological impairments after ACL injury – Do we know what we are addressing? Experiences from sports physical therapists. *Scand J Med Sci Sports.* 2021;31(7):1508-1517. doi:[10.1111/sms.13959](https://doi.org/10.1111/sms.13959)
15. Cederström N, Ageberg E, Granér S. Lived experiences of patients undergoing treatment for traumatic knee injury using integrated psychological training (MOTIFS) in the context of care-as-usual training: a phenomenological interview study. *BMJ Open Sport Exerc Med.* 2022;8(4):e001409. doi:[10.1136/bmjsem-2022-001409](https://doi.org/10.1136/bmjsem-2022-001409)
16. Chesterton P, Alexanders J, Rutter LK. A call for more psychological skills training: Examining the views of qualified and student sports therapists in the United Kingdom. *J Bodyw Mov Ther.* 2020;24(4):13-19. doi:[10.1016/j.jbmt.2020.06.010](https://doi.org/10.1016/j.jbmt.2020.06.010)

17. Sharma A, Minh Duc NT, Luu Lam Thang T, et al. A Consensus-based Checklist for Reporting of Survey Studies (CROSS). *J Gen Intern Med*. 2021;36(10):3179-3187. doi:[10.1007/s11606-021-06737-1](https://doi.org/10.1007/s11606-021-06737-1)
18. Cederström N, Granér S, Nilsson G, et al. Motor Imagery to Facilitate Sensorimotor Re-Learning (MOTIFS) after traumatic knee injury: study protocol for an adaptive randomized controlled trial. *Trials*. 2021;22(1):729-742. doi:[10.1186/s13063-021-05713-8](https://doi.org/10.1186/s13063-021-05713-8)
19. DeepL SE. DeepL Translator. In: Vol 2023. DeepL SE; 2017.
20. Heaney CA, Walker NC, Green AJK, et al. Sport psychology education for sport injury rehabilitation professionals: A systematic review. *Phys Ther Sport*. 2015;16(1):72-79. doi:[10.1016/j.ptsp.2014.04.001](https://doi.org/10.1016/j.ptsp.2014.04.001)
21. Morrey MA, Stuart MJ, Smith AM, et al. A longitudinal examination of athletes' emotional and cognitive responses to anterior cruciate ligament injury. *Clin J Sport Med*. 1999;9(2). doi:[10.1097/00042752-199904000-00004](https://doi.org/10.1097/00042752-199904000-00004)
22. Tegner Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. *Clin Orthop Relat Res*. 1985;198:42-49. doi:[10.1097/00003086-198509000-00007](https://doi.org/10.1097/00003086-198509000-00007)
23. Xiao M, van Niekerk M, Trivedi NN, et al. Patients who return to sport after primary anterior cruciate ligament reconstruction have significantly higher psychological readiness: A systematic review and meta-analysis of 3744 patients. *Am J Sports Med*. 2023;51(10):2774-2783. doi:[10.1177/03635465221102420](https://doi.org/10.1177/03635465221102420)
24. Swann C, Rosenbaum S, Lawrence A, et al. Updating goal-setting theory in physical activity promotion: a critical conceptual review. *Health Psychol Rev*. 2021;15(1):34-50. doi:[10.1080/17437199.2019.1706616](https://doi.org/10.1080/17437199.2019.1706616)
25. Callow N, Roberts R, Fawkes JZ. Effects of dynamic and static imagery on vividness of imagery, skiing performance, and confidence. *J Imag Res Sport Phys Act*. 2006;1(1). doi:[10.2202/1932-0191.1001](https://doi.org/10.2202/1932-0191.1001)
26. Guillot A, Moschberger K, Collet C. Coupling movement with imagery as a new perspective for motor imagery practice. *Behav Brain Funct*. 2013;9(1):1-8. doi:[10.1186/1744-9081-9-8](https://doi.org/10.1186/1744-9081-9-8)
27. Holmes PS, Collins DJ. The PETTLEP approach to motor imagery: A functional equivalence model for sport psychologists. *J Appl Sport Psychol*. 2001;13(1):60-83. doi:[10.1080/10413200109339004](https://doi.org/10.1080/10413200109339004)
28. Monfort SM, Simon JE, Miko SC, et al. Effects of cognitive- and motor-dual tasks on postural control regularity following anterior cruciate ligament reconstruction. *Gait Posture*. 2022;97:109-114. doi:[10.1016/j.gaitpost.2022.07.246](https://doi.org/10.1016/j.gaitpost.2022.07.246)
29. Plakoutsis G, Paraskevopoulos E, Zavvos A, et al. The effects of motor imagery on pain in lower limb sports injuries: A systematic review and meta-analysis. *Healthcare*. 2022;10(12). doi:[10.3390/healthcare10122545](https://doi.org/10.3390/healthcare10122545)
30. Nanbancha A, Mawhinney C, Sinsurin K. The effect of motor imagery and action observation in the rehabilitation of lower limb injuries: A scoping review. *Clin Rehabil*. Published online 2022:02692155221123546. doi:[10.1177/02692155221123546](https://doi.org/10.1177/02692155221123546)
31. Paravlic AH, Maffulli N, Kovač S, et al. Home-based motor imagery intervention improves functional performance following total knee arthroplasty in the short term: a randomized controlled trial. *J Orthop Surg Res*. 2020;15(1). doi:[10.1186/s13018-020-01964-4](https://doi.org/10.1186/s13018-020-01964-4)
32. Maddison R, Prapavessis H, Clatworthy M, et al. Guided imagery to improve functional outcomes post-anterior cruciate ligament repair: randomized-controlled pilot trial. *Scand J Med Sci Sports*. 2012;22(6):816-821. doi:[10.1111/j.1600-0838.2011.01325.x](https://doi.org/10.1111/j.1600-0838.2011.01325.x)
33. Blascovich J, Tomaka J. The biopsychosocial model of arousal regulation. In: Zanna MP, ed. *Advances in Experimental Social Psychology*. Vol 28. Academic Press; 1996. doi:[10.1016/S0065-2601\(08\)60235-X](https://doi.org/10.1016/S0065-2601(08)60235-X)
34. Lane AM, Beedie CJ, Jones MV, et al. The BASES expert statement on emotion regulation in sport. *J Sports Sci*. 2012;30(11):1189-1195. doi:[10.1080/02640414.2012.693621](https://doi.org/10.1080/02640414.2012.693621)
35. Yang SX, Cheng S, Su DL. Sports injury and stressor-related disorder in competitive athletes: a systematic review and a new framework. *Burns & Trauma*. 2022;10. doi:[10.1093/burnst/tkac017](https://doi.org/10.1093/burnst/tkac017)
36. Hardy L. Psychological stress, performance, and injury in sport. *Br Med Bull*. 1992;48(3):615-629. doi:[10.1093/oxfordjournals.bmb.a072567](https://doi.org/10.1093/oxfordjournals.bmb.a072567)
37. Walker JM, Brunst CL, Chaput M, et al. Integrating neurocognitive challenges into injury prevention training: A clinical commentary. *Phys Ther Sport*. 2021;51:8-16. doi:[10.1016/j.ptsp.2021.05.005](https://doi.org/10.1016/j.ptsp.2021.05.005)

38. Taberner M, Allen T, Cohen DD. Progressing rehabilitation after injury: consider the 'control-chaos continuum.' *Br J Sports Med.* 2019;53(18):1132. doi:[10.1136/bjsports-2018-100157](https://doi.org/10.1136/bjsports-2018-100157)

39. Podlog LW, Brown WJ. Self-determination theory: A framework for enhancing patient-centered care. *J Nurse Pract.* 2016;12(8):e359-e362. doi:[10.1016/j.nurpra.2016.04.022](https://doi.org/10.1016/j.nurpra.2016.04.022)

40. Deci EL, Ryan RM. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychol Inq.* 2000;11(4):227-268. doi:[10.1207/S15327965PLI11104_01](https://doi.org/10.1207/S15327965PLI11104_01)

41. Henriksen K, Hansen J, Larsen CH, eds. *Mindfulness and Acceptance in Sport: How to Help Athletes Perform and Thrive under Pressure.* 1st ed. Routledge; 2020. doi:[10.4324/9780429435232-1](https://doi.org/10.4324/9780429435232-1)

SUPPLEMENTARY MATERIALS

Appendix 1

Download: <https://ijspt.scholasticahq.com/article/126056-physical-therapists-use-of-psychological-skills-training-in-rehabilitation-following-traumatic-knee-injury-an-online-survey-study/attachment/254051.docx>
