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### 'The' pathway towards the elite level in Dutch basketball

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# Chapter 7

Psychosocial factors influencing the recovery of athletes with anterior cruciate ligament injury: A systematic review

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## Abstract

This review describes the psychosocial factors that affect recovery following anterior cruciate ligament (ACL) injury and reconstructive surgery in athletes. A systematic search in literature with inclusion and exclusion criteria on PubMed, PsycINFO, and Embase was performed. Articles used in this review were divided into five different parts according to the biopsychosocial model of Wiese-Bjornstal, with the addition of intervention studies. The results showed that a high internal Health Locus of Control and a high self-efficacy were useful cognitive factors to facilitate the recovery. Athletes with a low level of fear of reinjury had the best knee outcome after the injury followed by a reconstruction. In addition, athletes who returned to sport had less fear of reinjury and were more experienced and established athletes compared with athletes who did not return to sport. Furthermore, researchers showed that there was a positive relation between goal setting and adherence, which in turn yielded a positive relation with the outcome of the rehabilitation of an ACL injury. There were several psychosocial interventions that appeared to be facilitating the rehabilitation process.

Keywords: sports, rehabilitation, psychology, injuries

## Introduction

Anterior cruciate ligament (ACL) injuries happen about 250,000-300,000 times a year<sup>1</sup>. The number of ACL injuries has increased sharply over the last years because of higher sport participation rates and an increasing exposure to higher-risk sports<sup>1,2</sup>. Basketball, soccer, volleyball, handball, gymnastics, skiing, and martial arts are sports with the highest risk of ACL injury. The injury occurs most often during landing after jumping, changing direction, running, sudden stoppage (deceleration), and overextension of the lower leg<sup>3</sup>.

One of the adverse consequences of injuries is that an athlete cannot train full-time in his or her sport. Even worse, it might be the reason why talented athletes stop performing their sport<sup>4</sup>. To minimize these negative consequences, it is very important to ensure a successful outcome of the rehabilitation process (i.e., return to pre-injury level of activity) with regard to the ACL injury whether or not reconstructive surgery is performed. Besides the physical recovery of the injury, psychosocial aspects of the rehabilitation are of significant value. These psychosocial factors are in particular important for the recovery of an ACL injury, because this injury requires a long rehabilitation process and it is uncertain whether a player is able to return to his previous level again.

According to Wiese-Bjornstal (2010), the psychosocial responses of injured athletes consist of cognitive, affective, and behavioral factors<sup>5</sup>. As shown in figure 7.1, these factors interact with each other and again consist of several components. Cognition concerns the conscious assessments athletes make after an injury. Furthermore, the affective factors include emotions, feelings, and mood disturbances such as depression, anxiety, low vigor, fatigue, grief, and burnout. The behavior of the athlete refers to someone's effort, actions, and activities with regard to the injury. This behavior is in turn influenced by an athlete's cognition and emotions. Together, these three factors play an important role in the outcome of the injury.

Figure 7.1 indicates that psychosocial factors are related with the outcome of sport injury rehabilitation. In order to improve this rehabilitation, it is important to know which psychosocial factors can contribute to a good recovery (i.e., return to pre-injury level). Therefore, the purpose of this review is to give an overview of literature of the psychosocial factors that have an effect on the recovery of ACL injuries and reconstructive surgery in athletes.









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Study	Design	Sample	Measures	Findings	Conclusions
Study 1 (2018)	Experimental (random assignment)	100 Male 18-25 years	Self-regulation scale (SR)	Yes	Self-regulation is a key factor in the development of self-regulation
Study 2 (2019)	Experimental (random assignment)	100 Male 18-25 years	Self-regulation scale (SR)	Yes	Self-regulation is a key factor in the development of self-regulation

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Markham et al. (2012)	18	Male and female, 18-24 years, documented data on sex study	Survey conducted via online survey	Yes	Yes	Quality of research validity	Psychometric reliability	Psychometric reliability	Psychometric reliability
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## Cognition

The first part of the biopsychosocial model, as shown in figure 7.1, consists of cognition. According to Wiese-Bjornstal (2010), cognition includes the thoughts that athletes experience after an injury<sup>5</sup>. One of these cognitive factors involved with rehabilitation of ACL injury followed by reconstruction is internal Health Locus of Control (HLOC). This was studied by Nyland et al. (2006)<sup>8</sup>. HLOC is the degree to which individuals perceive their ability to control life events. Persons with a high internal HLOC experience life events as being a consequence of one's own personal actions. Likewise, persons with a low internal (more external) HLOC consider these events more as fate or chance, i.e., something that they cannot exert any control of. The main result of this study performed by Nyland et al. (2006) was that persons with a high internal HLOC were more satisfied with their knee function (measured by Knee Outcome Survey), their activities of daily living (measured by the Activities of Daily Living Scale), and their sports activities after ACL reconstruction (measured by Sports Activity Scale) compared with athletes with a low internal (more external) HLOC<sup>8</sup>.

With regard to self-efficacy, Thomeé and his colleagues performed three studies about this cognitive factor<sup>9-11</sup>. Self-efficacy refers to the judgment of a person's ability to perform a task, rather than whether he or she can actually do it<sup>10</sup>. First of all, Thomeé et al. (2007a) suggested that the internal locus of control and the way the patient felt about the knee function in sports and recreation activities were the best predictors of self-efficacy<sup>9</sup>. With this in mind, they concluded in their second study that patients' activities and their perceived self-efficacy increased during the rehabilitation process. However, being male, young, and more physically active preoperatively appeared to be favorable factors for a higher self-efficacy score<sup>11</sup>. Thomeé et al. (2007c) demonstrated also that patients' preoperative self-efficacy of knee function can predict the patients' outcome in terms of physical activity, knee symptoms, and muscle function 1 year after an ACL reconstruction<sup>11</sup>. Thomeé and colleagues give evidence for the fact that having more self-efficacy is beneficial for the rehabilitation process following ACL reconstruction.

Based on these four articles about cognitive factors, we can conclude that having a high internal HLOC and more self-efficacy preoperatively can improve the outcome after an ACL injury followed by a reconstruction.

## Affect

The affective responses concern the way athletes feel after an injury. Injuries can lead to major psychosocial changes, which have an influence on the rehabilitation process. Athletes with an ACL reconstruction experienced fewer negative emotions, felt more positive about returning to sport, and experienced less pain, as time progressed since surgery<sup>12,13,16</sup>. Negative mood and pain could be predicted by both personal variables (athletic identity, neuroticism, and optimism) and situational variables (perceived daily stress and physical activity)<sup>12</sup>. The decline in negative mood during the rehabilitation process was stronger in

patients high in athletic identity and low in optimism. A possible explanation for this last finding is that athletes low in optimism had a more negative mood at the beginning of the rehabilitation process than athletes high in optimism. However, the group low in optimism but high in athletic identity had a stronger decline in negative mood during the rehabilitation process (than athletes low in optimism and low in athletic identity). The pain experiences of patients decreased when time progressed since surgery, but the degree of decrease was less over time. Significant differences in psychosocial responses were found in those who did and did not return to sport after injury. Athletes who had more doubts about returning to sport returned less often to their sport compared with athletes who experienced less doubts<sup>16</sup>.

Fear of reinjury is a factor that has a negative influence on the rehabilitation of an ACL injury followed by a reconstruction. Fear of reinjury, as well as a worse knee-related quality of life, was considered as a hindrance for returning to sport<sup>13-15</sup>. Furthermore, fear of reinjury consists of concerns about the inability to return to preinjury sport/activity levels and possible functional impairments<sup>13,14</sup>. The rate of fear of reinjury was highest in periods when patients tried to return to sports activities<sup>13</sup>. The results of Heijne et al. (2008) showed that all participants had a fear of going back to the sports they performed before the ACL injury<sup>14</sup>. In their study, they interviewed 10 patients about their experiences during the rehabilitation period. Besides fear of reinjury, all patients became frustrated because the recovery of the ACL injury and surgery took longer than expected. As a result of this, individuals lost confidence in their rehabilitation process and self-esteem.

Together, these studies showed that there were positive psychosocial changes as rehabilitation progressed, i.e., fewer negative emotions, more positive feelings about returning to sport, and less pain. However, individuals experienced a fear of reinjury that had a negative influence on their rehabilitation process.

## Behavior

In the context of rehabilitation following an ACL injury and reconstruction, the behaviors reviewed here were avoidance coping and rehabilitation adherence. Avoidance coping can be divided into two different types: behavioral avoidance coping, which was defined as "the conscious decision to remove oneself from a threatening environment," and cognitive avoidance coping, which was defined as "the responses aimed at denying or minimizing the seriousness of a crisis or its consequences"<sup>18</sup>. The four professional rugby players in the study of Carson and Polman (2010) used both behavioral and cognitive avoidance coping strategies in their rehabilitation process<sup>18</sup>. The interviews with these rugby players showed that these coping strategies were useful for the recovery of their ACL injury and reconstruction in both short term and long term.

Another behavior that is of important value in recovering from ACL injury and reconstruction is adherence to the rehabilitation program. Adherence to clinic-based activity was strongly related to the outcome compared with

adherence to home exercises<sup>17</sup>. Patients who had a higher score for adherence experienced fewer knee symptoms, suggesting that adherence to the rehabilitation program has a positive effect on the recovery from the ACL injury and reconstruction. Setting goals had a beneficial effect on both rehabilitation adherences (rehabilitation sessions and home rehabilitation exercises). In addition, positive self-talk appeared to have a positive correlation with adherence to home rehabilitation exercises<sup>19</sup>.

The abovementioned studies indicate that the behavior of individuals with an ACL injury could influence the outcome of the recovery. This recovery is positively reinforced when someone pays attention to alternative goals and follows all the exercises and training sessions imposed by the trainer or physiotherapist.

### Outcome

A measure for the success of recovery from an ACL injury and reconstruction is often represented by whether or not someone gets back to their pre-injury sports activity level. This is indicated by the term "return to play" or "return to sport." Studies included in this review showed that 41-92% of the athletes returned to their previous level of sport<sup>20-23</sup>. A significant amount of athletes failed to return to sports because of fear of reinjury, pain related to chondropathy, and having an unstable knee. According to Gobbi and Francisco (2006), there were significant differences between those who did and did not return to sport<sup>21</sup>. The first group had better scores on the Marx scale (knee activity rating scale) and the Psychovitality Questionnaire, and experienced less fear of reinjury and less negative affect<sup>22,25</sup>. Athletes who did return to sports were also more experienced, i.e., played more than 4 years in the National Football League, and more established athletes. Less-experienced athletes had a lower rate of return to sports probably due to the fact that they had poorer facilities<sup>23</sup>. Another study with regard to the outcome of the ACL injury and reconstruction was performed by Swirtun and Renström (2008)<sup>24</sup>. They demonstrated that personality traits had an influence on the outcome of the ACL injury recovery period. Individuals who had fewer problems in the pain and symptom subscores were lower in embitterment than persons who had more problems in these subscales.

In conclusion, after having an ACL injury, whether or not reconstructive surgery is performed, not all athletes returned to sports. One of the main reasons for not returning back is fear of reinjury. Other reasons could be pain and having an unstable knee.

### Psychosocial interventions

With the aim to improve the recovery of patients with an ACL injury, whether or not reconstructive surgery is performed, researchers have evaluated interventions that could be beneficial for the rehabilitation. Cupal and Brewer (2001) investigated whether relaxation and guided imagery had any effect on knee strength, reinjury anxiety, and pain after a reconstruction of the ACL<sup>26</sup>.

Three different groups (treatment, placebo, and control) were compared with each other. The treatment consisted of 10 individual sessions of relaxation and guided imagery. Besides this intervention, these individuals followed normal physical therapy according to the sports medicine facility's protocol for physical therapy after ACL reconstruction. Participants in the placebo group followed also normal physical therapy, with the addition of attention, encouragement, and support from the clinician. Individuals of the control group followed only normal physical therapy with no additions. The hypothesis that participants from the treatment group (i.e., inclusive sessions of relaxation and guided imagery) had greater knee strength, less reinjury anxiety, and less pain compared with the placebo and control group was confirmed.

With regard to increasing self-efficacy following ACL injury and reconstruction, modeling and specific training for improving patients' self-efficacy appeared to be useful<sup>27,31</sup>. According to Maddison et al. (2006), modeling could reduce the perception of pain and anxiety of a person and increase the self-efficacy during the rehabilitation of ACL reconstruction<sup>27</sup>. Participants were divided into two groups: 30 participants were randomly assigned to the intervention group and 28 participants were assigned to the control group. The persons of the intervention group viewed two coping model videos. Results showed that there was a significant effect for perception of expected pain; individuals who watched the videos reported less pain. The modeling video was useful for increasing self-efficacy early in rehabilitation. Thus, persons who watched the videos perceived less pain and had more self-efficacy than persons of the control group. In a research of Thomeé et al. (2010), all patients underwent a standardized rehabilitation program but they were divided into two different groups<sup>31</sup>. There were two differences between the experimental (n=12) and the control group (n=12). The participants of the experimental group received specific training to enhance their self-efficacy based on a clinical model, and the physiotherapists treating these patients gave them their self-efficacy scores. The clinical model consisted of four different phases (understanding, maturity, persistence, and coping), which physiotherapists used to exert a positive influence on the patients, and in this way increasing their self-efficacy. Using this model, physiotherapists attempt to provide the patients more information about their injury, the rehabilitation process, setting goals, and performing exercises regarding the recovery. The researchers concluded, in contrast with the hypothesis, that patients with an ACL injury who received strategies to enhance self-efficacy had no better outcome than patients of the control group. This indicates that the clinical rehabilitation model used in this study of Thomeé et al. (2010) is unable to increase self-efficacy of patients with an ACL injury<sup>31</sup>.

Athletes with an ACL injury, whether or not reconstructive surgery is performed, often inhibit negative emotions due to their injury. An intervention that tried to prevent this consists of writing about the trauma, i.e., a written disclosure intervention<sup>28</sup>. This study of Mankad et al. (2009) showed that emotional disclosure during recovery could have positive effects on injured athletes, because it caused a reduction of stress and total mood disturbances.

Myers et al. (2004) investigated the treatment acceptability in football

players<sup>29</sup>. Players were asked to assess two different psychosocial treatments for the recovery of an ACL injury. The behavior treatment consists of positive self-talk, imagery, relaxation training, and goal setting strategies, and the counseling treatment was focused on the relationship between the counselor and the player, a general feeling of acceptance and increasing emotional awareness and resulting catharsis. Counseling skills had an influence on components of social support. For example, it provided emotional support and helped patients cope with negative feelings (listening support)<sup>30</sup>. In the study of Myers et al. (2004) there was a relation between the years of football experiences and the acceptability of the behavioral treatment (the experienced players were more open to the behavioral treatment than less-experienced players)<sup>29</sup>. Furthermore, both treatments were considered as moderately acceptable. The latter finding is relevant for practice because the authors assumed a relation among the acceptability, treatment adherence, and resulting efficacy. Rock and Jones (2002) determined that interventions with counseling skills were useful for the rehabilitation of an ACL injury and surgery in terms of emotional, listening, and informational support<sup>30</sup>. This social support has in turn a positive influence on the adherence to rehabilitation. Furthermore, counseling skills interventions might be useful for coping with setbacks during rehabilitation.

In conclusion, psychosocial interventions, such as relaxation, imagery, training of self-efficacy, and modeling, were advantageous in facilitating the rehabilitation of an ACL injury whether or not reconstructive surgery is performed.

## Discussion

An ACL injury can have major consequences for the development of further sports activities. Besides the physical recovery of the knee, the psychosocial aspect of rehabilitation receives increasing attention in literature. The purpose of this review was to give an overview of literature of the psychosocial factors that have an effect on the recovery of ACL injury and reconstructive surgery in athletes. The biopsychosocial model of Wiese-Bjornstal (figure 7.1) was used as a basic framework and all aspects of this model are interrelated and influencing each other<sup>5</sup>. Besides the four components of this original biopsychosocial model, our results showed that interventions also have an important role with regard to the rehabilitation of ACL injury and reconstructive surgery. So, to optimize the original model, we propose to add the factor psychosocial interventions. These interventions appeared to have an influence on the cognition and affect parts of the original model. These two parts in turn had an influence on the behavior of athletes with an ACL injury, and this is affecting the outcome of the recovery. An example of the multiple interactions in this model is represented as follows: Maddison et al. (2006) showed that watching a modeling video (intervention) led to more self-efficacy (cognition)<sup>27</sup>. Patients with more self-efficacy have more confidence in their rehabilitation process and experience less fear of reinjury (affect). This latter is in turn favorable for returning to sports after the

injury (outcome). The four components of the original model will be discussed separately in the next sections. As we suggest psychosocial interventions as a fifth part of the model, these interventions will be addressed in each of the following: cognition, affect, behavior, and outcome sections.

### Cognition

Based on the articles about cognitive factors, we can conclude that having a high internal HLOC and a high self-efficacy score preoperatively could improve the outcome after an ACL reconstruction<sup>8-11</sup>. This is not surprising because both factors concern the confidence of a person in its own qualities. Having confidence in the rehabilitation of the knee injury facilitates a positive outcome. Patients with more self-efficacy perceive the outcome of the rehabilitation process as a result of their own behavior, i.e., they have a higher internal locus of control compared with patients with less self-efficacy<sup>9</sup>. Because of the fact that self-efficacy appeared to have a significant value in the outcome of the rehabilitation process, several researchers developed psychosocial interventions for improving this self-efficacy. According to Maddison et al. (2006), watching a modeling video is a successful intervention for the recovery of an ACL injury and reconstructive surgery<sup>27</sup>. Because of this modeling video, patients' self-efficacy will increase, which in turn will lead to less pain because there is a negative correlation between these two cognitive factors<sup>32</sup>. So, watching a modeling video could be a useful addition of existing rehabilitation programs.

### Affect

Athletes perceive, especially in the initial phase after the onset of the injury, negative thoughts and depressed feelings<sup>33</sup>. These emotional experiences consist particularly of anxiety, fear, anger, confusion, and frustration<sup>14,34</sup>. These emotions were also reflected in the biopsychosocial model of Wiese-Bjornstal, and studies have shown that these feelings change over time<sup>16</sup>. For example, pain and negative mood decreased when rehabilitation progressed, which is beneficial for the recovery<sup>12,13,16</sup>. The decrease in negative mood appeared to be strongest in patients who had a high level of athletic identity<sup>12</sup>. Individuals with a high level of athletic identity perceived dealing with stressful events, such as recovering from an injury, as a task that belongs to athletes. This ensures that athletes with a high level of athletic identity were more emotionally resilient, which is advantageous for recovering of an ACL injury and reconstructive surgery<sup>12,33</sup>.

Another emotion that appeared in the rehabilitation context is frustration. Patients with an ACL injury mentioned that their rehabilitation period lasted longer than they previously expected. Because of this, feelings of frustration, and lost of confidence in the recovery and in their self-esteem emerged<sup>14</sup>. To prevent this feeling of frustration, therapists should preoperatively meet the patients to ensure a more realistic view of what the patients have to expect after surgery<sup>20</sup>. Likewise, interventions that contain counseling skills appeared to be useful

for the rehabilitation of an ACL injury and should be applied by the treatment team of an athlete with ACL injury. By this, patients experienced emotional, listening, and informational support that makes them better in assessing the progress of their recovery and get less frustrated<sup>30</sup>. This social support is in more ways important for the recovery of the knee injury because it had a positive influence on the adherence to rehabilitation<sup>30</sup>. Rock and Jones (2002) suggested that an increase in social support through the use of counseling skills led to an increase in adherence to rehabilitation. Another positive relation regarding adherence was found between positive self-talk and adherence<sup>17,19</sup> and between setting goals and rehabilitation adherence<sup>14,19</sup>. By setting goals (cognition), athletes were more directed to their rehabilitation program, leading to a better adherence (behavior) and a better outcome of the knee. This is an example of the interactions between the several aspects of the biopsychosocial model we used in this review. The recommendation for those treating athletes with an ACL injury is to encourage these patients to use positive self-talk and set achievable goals for themselves.

Athletes often inhibit all those abovementioned emotions during their rehabilitation. Mankad et al. (2009) hypothesized that writing about injury-related emotions, i.e., disclosing the emotions, could be beneficial for the rehabilitation process of patients who underwent an ACL reconstruction<sup>28</sup>. Results showed indeed reduced stress levels and less mood disturbance after athletes had undergone this intervention. Another outcome was the common use of suppressive coping strategies among the participants, which they used to maintain a positive appearance to their environment, even though they experienced emotional distress. So, writing about emotions during the recovery period is another potential intervention that could be useful for athletes with an ACL injury.

### Behavior

In line with coping strategies, Carson and Polman (2010) showed that behavioral as well as cognitive avoidance coping strategies were used equally by the professional rugby players in this study, and that these strategies had positive short- and long-term effects<sup>18</sup>. A common type of strategy was the use of both behavioral (e.g., performing a new hobby) and cognitive (e.g., refusing to watch games) distraction coping. Furthermore, each player indicated the need to dissociate themselves from the whole situation, so the player could manage stressful, uncontrollable situations. Despite the beneficial effect of avoidance coping strategies, athletes should be aware of the negative effects of these strategies when used excessively, for example, when there is too much deviation from his or her normal lifestyle.

### Outcome

Fear of reinjury was the most common cause in athletes with an ACL injury and reconstructive surgery who failed to return to sports<sup>13,15,21,22,25</sup>. Remarkable was

that none of the 10 participants of the study of Tracey (2003) experienced a fear of reinjury<sup>33</sup>. These athletes indicated that they were more concerned about healing and return to sports participation than about the possibility of reinjury. They experienced rather other fears, such as fear of loss of independence, fear of asking for assistance, and fear of losing a spot in the team. The differences between the results of Tracey (2003) and other studies may be due to the instrument used. Tracey determined the fear of reinjury by conducting interviews<sup>33</sup>, while other studies, with the exception of Heijne et al. (2008)<sup>14</sup>, used the Tampa Scale of Kinesiophobia, which has proved to be valid and reliable. The rate of fear of reinjury appeared to be dependent on the time after surgery and the level of optimism<sup>12,13</sup>. Fear of reinjury decreased with time after surgery and was associated with function of the knee, only in the period when patients were returning to sports<sup>13,33</sup>. One of the articles about interventions made a suggestion for therapists to reduce the fear of reinjury<sup>26</sup>. These researchers showed a significant lower level of reinjury anxiety among athletes due to the relaxation and imagery sessions.

This review tried to give an overview of literature of the psychosocial factors that have an effect on the recovery of ACL injury and reconstructive surgery in athletes. As expected, cognition, affect, behavior, and outcome were all influenced by each other. For example, athletes with a low level of optimism (cognition) were more afraid of getting reinjured (affect), which caused a lower rate of returning to their sports (outcome). Furthermore, possible interventions were shown to improve these psychosocial factors in order to facilitate the rehabilitation. After evaluating these interventions, we can conclude that psychosocial factors that had an influence on the recovery could be positively affected by interventions. Though, further research should be done to optimize the effectiveness of these interventions and to determine how these interventions can be applied in already existing rehabilitation programs. In any case, it is clear that the psychosocial recovery of an ACL injury and reconstructive surgery is of very important value.

## Perspectives

To ensure a good recovery of ACL injury and reconstructive surgery in athletes, it is important to understand the factors that are related to this rehabilitation process. The model of Wiese-Bjornstal (2010)<sup>5</sup> appeared to be a good starting point, because it shows that cognition, affect, behavior, and outcome are related with each other and thus have all an influence on the recovery of an ACL injury. The information in this review may be important for rehabilitation specialists, who help athletes to recover from ACL injury and reconstructive surgery. With regard to the variables mentioned in this review, they could design and apply interventions in rehabilitation settings to make sure an athlete recovers well from his or her ACL injury. Especially for athletes, a quick and successful recovery (i.e., return to pre-injury level) is important to limit all the negative consequences of

the injury and to make sure that athletes can train and play full-time as soon and safely as possible.

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