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RESEARCH PAPER

Illness perceptions and mood states are associated with injury-related outcomes in athletes

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Abstract

Background. Athletes have to cope adequately with the consequences of their injury in order to return into sports as soon as possible. Besides the physical characteristics of the injury, illness perceptions and emotional responses impact the behavioural responses to the injury.

Purpose. To apply Leventhal's Common Sense Model as a theoretical framework in the field of sports medicine, pertaining to injured athletes.

Methods. In a sample of 95 injured athletes participating in different sports, sociodemographic, injury and sport-related characteristics, the Illness Perception Questionnaire-Revised-Sports (IPQ-R-S) and the Profile Of Mood States were assessed.

Results. Injured athletes' most experienced symptoms were pain (82%) and loss of strength (50%), associated with a high controllability; they see their injury as not chronic, with minor consequences for daily life and minor emotional consequences. Athletes with an injury of longer duration have minor psychological attributions, 28% suffer from fatigue, which is strongly related to a negative mood state.

Conclusions. Illness perceptions and mood states are related to injury characteristics. Clinicians ought to incorporate patients' views about their injuries into their treatment in order to increase the concordance between patient's and clinician's perceptions, thereby increasing chances of a quick and uneventful recovery.

Keywords: *Athletes, mood, illness perception*

Introduction

In the last decades, knowledge has accumulated showing that regular involvement in sports or physical exercise improves well being [1]. Most athletes, however, will at a certain point in time get injured. In a study of 15 different sports with a follow-up of 16 years, Hootman et al. [2] described incidence rates of 13.8 sports injuries per 1000 athletes-exposures in games, and 4.0 in training. Injuries will lead to time loss in sport participation and training [3]. Besides physical consequences, injuries lead to psychological and social consequences. Athletes have to cope with these consequences in order to return to sports as quickly as possible. Besides the 'objective somatic' characteristics of the injury it is of major importance for healthcare professionals to understand this coping process and the psychological factors interfering in this process [4,5]. Healthcare professionals with insight in this coping process are better capable of giving patients tailored advice.

Several models have been adopted to provide a theoretical psychological framework for injured athletes. In a model, several variables are of importance, such as injury-related stress, cognitive appraisal, coping responses, rehabilitation adherence and clinical outcomes [5–7]. Wiese-Bjornstal et al. [8] described an integral model of psychological responses to sports injuries and the rehabilitation process. This model includes cognitive, emotional and behavioural responses, mediated by personal

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(characteristics of injury, personality, demographics, physical factors) and situational factors (sport-specific, social and environmental involvement).

In the medical and psychological literature, Leventhal's Common Sense Model (CSM) [9] is often used as a theoretical psychological framework. According to this theory, in case of an illness or injury the adopted coping procedures are responses to cognitive and emotional components simultaneously (Figure 1). This model has been proven useful in several diseases, such as patients with end stage renal disease [11], Huntington's disease [12], fibromyalgia [13], low back pain [14], head and neck cancer [15].

In a meta-analysis of 45 studies adopting the CSM, the examination of the relation of illness perceptions and emotional responses to coping and illness outcome is described [10]. From this meta-analysis, it can be concluded that when patients or athletes are confronted with an illness or with physical symptoms, such as in a sports injury, they create mental representations of their injury. These mental representations arise through concrete and abstract sources of information. Sources of information can be general information from previous social communication, e.g. other athletes who suffered from comparable injuries, cultural knowledge, information from the external environment like healthcare professionals and from the current or previous experiences with the injury referring to somatic or symptomatic experiences.

Research has suggested that illness perceptions have common content and can be ordered in five dimensions: identity, causes, consequences, time line and personal control (Figure 1). Identity refers to athletes' perceived symptoms, such as pain, fatigue, muscle weakness and whether these symptoms are perceived to be related to the sports injury. Perceiving many symptoms can be related to the tendency of somatisation [16]. The cause dimension reflects the beliefs of an athlete about the causes of the injury. The consequence dimension reflects an athlete's personal evaluation of the impact of the injury on his or her personal life. The timeline reflects the beliefs about the course of the injury: acute or chronic. Personal control refers to the athlete's beliefs about the availability for personal control or cure of the injury. Together with the emotional representation dimension this leads to a behavioural coping strategy, which shapes and impacts the outcome of the adaptation process. Appraisal of this coping strategy will lead to new illness perceptions and emotional representations, and to possible new coping strategies and associated changes in outcome (e.g. quality of life, treatment adherence, resumption of sporting activities) [15].

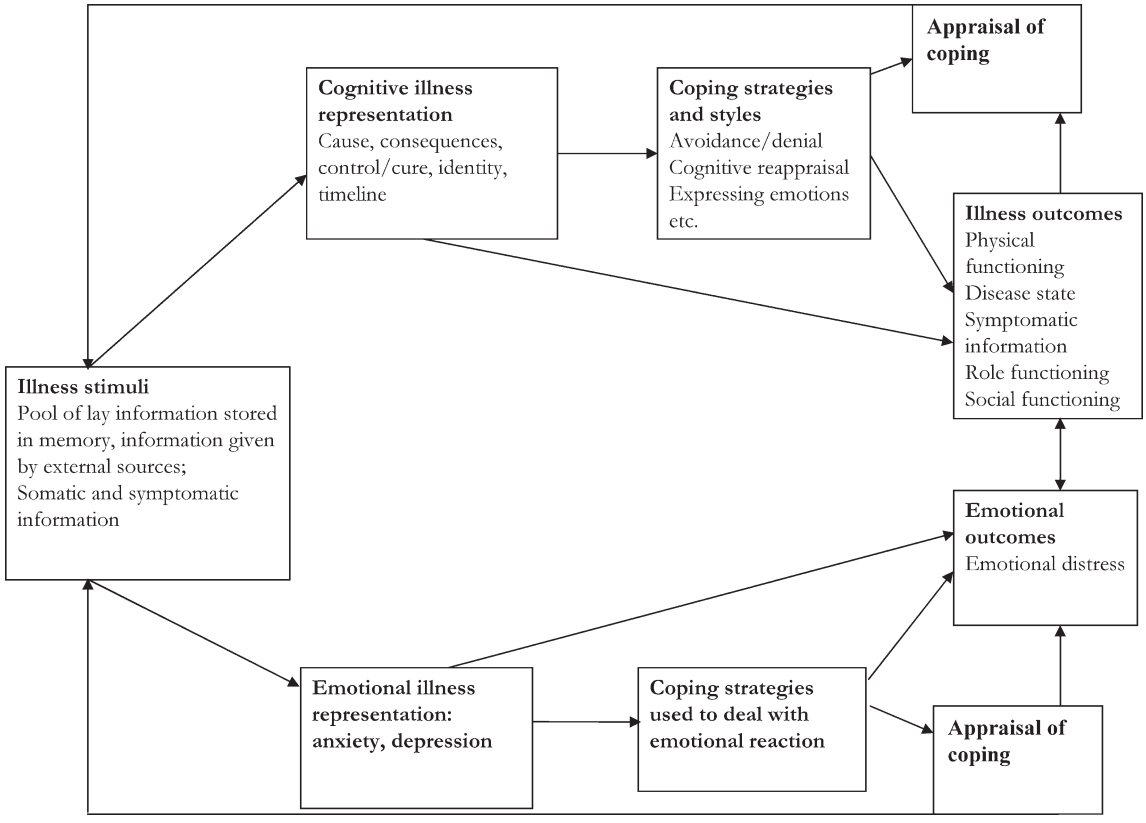

Figure 1. Leventhal's CSM of illness representations (adapted from Hagger and Orbell [10]).

In order to assess illness perceptions, Weinman et al. [17] developed the Illness Perception Questionnaire (IPQ). This IPQ was later revised by Moss-Morris et al. [16] into the IPQ-R (R for revised).

Hagger et al. [6] introduced Leventhal's CSM in the sports literature using the IPQ-R in 220 undergraduate students with sports-related injuries and examined the influence of illness perceptions on emotions, coping, and functional outcome. Identity, causal attributions and emotional representations influenced physical functioning, and the dimensions identity, consequences, causal attributions and emotional representations predicted sport functioning. Illness perceptions are investigated in athletes undergoing rehabilitation following knee surgery, those who had more negative cognitive appraisals of the injury experienced greater emotional disturbances. These emotional disturbances were negatively related to treatment attendance during rehabilitation [18]. Several other studies found that illness perceptions (cognitive appraisals, stronger beliefs in the treatment efficacy, higher value attached to the treatment) were related to compliance in rehabilitation [5,19,20].

Besides illness perceptions, emotional factors have also been found to be important in the occurrence of a sport injury [4,8]. It is concluded that athlete's mood states and perceptions change across time during the injury. To assess emotional responses of athletes often the Profile Of Mood States (POMS) questionnaire is used [8]. The POMS is constructed in five domains: negative mood depression, anger, fatigue, positive mood vigour and tension.

The aim of this present study is to investigate illness perceptions and mood states, and to examine the associations between these outcomes on injury-related outcome, i.e. duration, pain and fatigue. Our study contributes to the body of knowledge on how injuries may be related to illness perceptions and mood states, which may offer opportunities for evidence-based intervention strategies that are geared to the specific profile of illness perceptions of an athlete and therefore, to a better adaptation process to the injury.

Materials and methods

Patients

Injured athletes were recruited from the Centre for Sports Medicine of the University Medical Centre Groningen, the department of Physiotherapy of Medical Centre Leeuwarden, and from primary care physical therapy practices in the province of Groningen. Injured athletes were asked by their sport physician or (sport) physical therapist to participate in the study. The athletes who were willing to participate filled out the questionnaire, which they could send to the investigators by regular mail.

Inclusion criteria were as follows: injured during sport practice, age between 18 and 65 years, medical attention was needed [21], recreational and competitive athletes, participating in sports at least once a week with the aim return to sports. The following sociodemographic and clinical data were collected: gender, work status, education, age, pain and fatigue. Pain and fatigue were assessed with a Numbered Rating Scale (NRS) 0–10 [22]. Athletes filled out the number of years and hours a week they participated in sports before the injury, the kind of sport that was practiced when the injury occurred, frequency of injuries before the current injury, injured body sites (minimum 0 to maximum 30), duration of injury, and aetiology of the injury (acute-trauma related injury or overuse injury). Prior to participation, the athletes received an information letter and signed an informed consent form. The study was executed according to the medical ethical regulations of our hospital; approval from the medical ethical committee was not required as according to Dutch law on medical research, the questionnaires did not pertain to personal, sensitive issues.

Instruments

For the assessment of illness perceptions of injured athletes, the IPQ-R adapted for sports injuries was used. The IPQ-R can be used in different patient groups by adapting the questionnaire to that specific patient group. In our study the original translated IPQ-R (Dutch language version) was used. In this version 'my illness' was changed to 'my injury'; the adapted questionnaire was labelled 'IPQ-R-Sports (IPQ-R-S, Dutch language version)'.

The IPQ-R-S consists of eight 'dimensions' and five 'attributions'. In the first dimension athletes were asked if they experienced specific symptoms and whether they believed these symptoms were related to their injury. This 'Identity' dimension represents the number of symptoms attributed to injury. From the original IPQ-R, the symptom 'sore eyes' was replaced by a more sport-specific symptom, i.e. 'too much energy'. In the following seven dimensions of the IPQ-R-S, athletes were asked to indicate their degree of agreement on items, with a 5-point scale (1, strongly disagree, to 5, strongly agree), with statements concerning: acute/chronic timeline (5 items about the perception of chronicity of the injury, e.g. 'my injury will last for a long time'), cyclical timeline (4 items about the cyclical nature of the injury, e.g. 'the symptoms of my injury are

puzzling to me'), consequences of the injury (6 items about the negative consequences of the injury, e.g. 'my injury has major consequences on my life'), personal control (6 items representing positive beliefs about personal controllability of the injury, e.g. 'the course of my injury depends on me'), treatment control (5 items representing positive beliefs about the treatability of the injury, e.g. 'my treatment can control my injury'), illness coherence (5 items about the personal understanding of the injury, e.g. 'I don't understand my injury') and emotional representation (6 items about emotions caused by injury, e.g. 'when I think about my injury I get upset'). High scores on the identity, timeline (acute–chronic and cyclical) and consequences represent strongly held beliefs about the number of symptoms attributed to the injury, the chronicity and cyclical nature and the negative consequences of the injury. High scores on personal control, treatment control and illness coherence represent positive beliefs about controllability of the illness and personal understanding of the injury.

Causal attributions were measured by athletes' responses to the IPQ-R-S causal items. This domain consists of 18 items which can be divided into four sub-dimensions: (a) psychological attributions, such as personality, stress or worry (6 items), (b) risk factors, such as heredity and smoking (7 items), (c) immunity like germs or viruses (3 items) and (d) accident or chance (2 items). These causal attributions can be used for any disease. Because athletes probably have specific sports-related attributions for their injuries, we added a fifth sport-specific attribution domain containing 10 specific causal attributions related to sport injuries, namely: hit by opponent, overuse, bad or a changed technique, inappropriate sports material for instance sport shoes, bad physical condition, inappropriate training schedules, fault of trainer/coach, inattentiveness or a bad preparation or warming-up. At the end of the IPQ-R-S administration, athletes were asked to list a maximum of three causes for their injury in their own words. For scoring the IPQ-R-S we refer to Moss-Morris et al. [16]. The sport-specific causes are summed (minimum 10 to maximum 50) according to the other attribution scales of the IPQ-R-S.

To assess mood status the Dutch revised version of the POMS was used [23]. The POMS has been used extensively over the last years to understand the emotional responses to injuries [8] as well as to understand the relation between pre-competitive mood states and athletic performance [24]. Originally the POMS consisted of 65 items. After factor analysis, support was found for a shortened version with 24 items and 6 dimensions [25]. For the Dutch POMS however, support was found for 5 domains and 32 items, namely: negative mood depression (8 items), anger (7 items), fatigue (6 items), positive mood vigour (5 items), and tension (6 items), with adequate reliability and validity [26].

Statistical analysis

All data were entered using the Statistical Package for the Social Sciences (SPSS) 14.0. Descriptive statistics were used to describe the sociodemographic data and history of the injury and history of sports. The internal consistencies (Cronbach's α) of each dimension and attribution of the IPQ-R-S and POMS were calculated. Pearson's correlation coefficients were computed univariately to investigate the interrelationships of the used data: injury-related outcome (duration, pain, fatigue), the dimensions and attributions of the IPQ-R-S and the POMS subscales. The relation of injury-related outcome with dichotomy variables (gender, aetiology) were analysed using χ^2 test. All determinants which were statistical significant at the $p \leq 0.01$ level were entered in a multiple regression equation (method backwards). Interaction terms were analysed and if significant, entered into the analyses. Since fatigue and the dimension POMS fatigue have overlap, the analysis was performed without the POMS fatigue dimension. A collinearity analyses (variance inflation factors (VIF)) was applied; values above 10 were considered an indication of collinearity. An analysis of the residuals was applied to investigate if these were normally distributed. The most often mentioned causes by athletes in the open question were listed and divided into internal and external attributed causes. This classifying of the causes was performed by two researchers individually. In case of discrepancy the classifications were discussed until agreement was reached.

Results

Of the 151 questionnaires that were distributed, 101 were returned (response rate 67%). Of the 101 participating athletes, five were excluded because they were under 18 years of age and one athlete was no longer injured. The data of 95 athletes were analysed. Sociodemographic and background characteristics are presented in Table I. A diverse sample of athletes was included in the study. Of the sample, 49 athletes (52%) practiced two or more sports; the first mentioned sports are presented in Table I. All patients were under medical care during the study due to the injury, most athletes received physical therapy (90%). The aetiology of injuries was divided into overuse injuries (38%) and acute/trauma-related injuries (62%).

Table I. Sociodemographic data, pain, fatigue, hindrance in daily life, sports characteristics, clinical characteristics of the injury and etiology ($n = 95$).

Gender	Male	56 (59%)
Age	Female	39 (41%)
	Years	Mean 30 sd 11.5
Socioeconomic status	Working	55 (58%)
	Unemployed	1 (1%)
	Student	39 (41%)
Education	Elementary/Middle school	2 (2%)
		25 (26%)
	High school	68 (72%)
	College/University	
	Years	
Pain severity in daily life	NRS* 0–10	Mean 3.9 sd 2.4
Fatigue in daily life	NRS* 0–10	Mean 2.7 sd 2.5
Number years active in sports	Years	Mean 18.3 sd 19.4
Sports	Soccer	24
	Running	16
	Athletics	11
	Cycling/mountain bike	8
	Volleyball	6
	Hockey, Judo	4
	Basketball	3
	Dancing, fitness,	2
	kite/windsurfing,	1
	tennis, (figure) skating	
	Handball, horse riding, pencak silat, rowing, teakwondo, triathlon, skeelering, gymnastics, sailing	
Frequency of being injured	Never	7 (7%)
	Almost never	24 (25%)
	Sometimes	24 (25%)
	Regularly	28 (30%)
	Often	9 (10%)
	Very often	3 (3%)
Body sites of injury	Head, neck	7 (7%)
	Back	12 (12%)
	Shoulder	5 (5%)
	Hip	5 (5%)
	Leg upper/lower	15 (16%)
	Knee	41 (43%)
	Ankle	8 (8%)
	Foot	2 (2%)
Duration of injury	0- 26 weeks	48 (51%)
	27 - > > weeks	47 (49%)
Etiology	Overuse	36 (38%)
	Trauma or contact	59 (62%)

*NRS = Numbered Rating Scale.

Means and standard deviations of the IPQ-R-S dimensions and attributions are presented in Table II. Injured athletes were shown in this study to have a weak illness identity, associated with a high controllability; they see their injury as not chronic, and with minimal serious consequences. They understand the nature of their injury according to high illness coherence and do not have a strong emotional representation. Internal consistency of the IPQ-R-S is adequate for the dimensions and attributions except for the attribution accident or chance. The attribution items of the injury that were filled out most frequently were: bad luck, physical overuse, my own behaviour, overtraining, bad or changed technique, inappropriate sports material and inattentiveness. The most common experienced symptoms were pain (82%), loss of strength (50%), weight gain (37%), stiff joint (28%) and fatigue (28%).

Table II. Mean, standard deviations, internal consistency of the IPQ-R-S dimensions and attributions, and of the profile of mood states ($n = 95$).

Dimension of IPQ (# items)	Range	Mean (SD)	Internal Consistency Cronbach's α
Identity (14)	0–14	3.1 (16)	
Timeline (acute/chronic) (6)	6–30	16.6 (5.3)	0.86
Consequences (6)	6–30	15.0 (4.5)	0.76
Personal control (6)	6–30	22.1 (4.6)	0.83
Treatment control (5)	5–25	19.7 (3.4)	0.81
Illness coherence (5)	5–25	19.8 (4.7)	0.92
Cyclical timeline (4)	4–20	10.0 (3.7)	0.81
Emotional representation (6)	6–30	14.7 (4.7)	0.85
Attributions			
Psychological attribution (6)	6–30	8.9 (3.6)	0.78
Risk factor attribution (7)	7–35	11.5 (3.6)	0.63
Immune attribution (3)	3–15	3.6 (1.2)	0.77
Accident or chance attribution (2)	2–10	6.1 (2.2)	0.49
Sport-specific attributions (10)	10–50	20.4 (6.6)	0.76
POMS			
Depression	0–3	0.75 (0.76)	0.92
Anger	0–3	1.04 (0.85)	0.92
Fatigue	0–3	0.91 (0.80)	0.88
Positive mood vigour	0–3	2.13 (0.78)	0.77
Tension	0–3	0.90 (0.77)	0.85

The inter-correlations ($p \leq 0.1$) for duration of the injury were: timeline acute-chronic, psychological attributions and positive mood vigour (Table III). For pain, inter-correlations ($p \leq 0.1$) were gender, identity, consequences, personal and treatment control, timeline cyclical psychological attributions, sport-specific attributions, POMS anger and fatigue. The correlations ($p \leq 0.01$) for fatigue were identity, timeline acute/chronic and cyclical, consequences, personal and treatment control, emotional representation, POMS depression, anger, fatigue, positive mood vigour, tension.

In the collinearity analyses no VIF values above 10 were found. In the analyses of the residuals no heteroscedasticity was found. The results of the regression analyses (backwards entry) are presented

Table III. Pearson's correlations between IPQ-R-S dimensions and attributions, injury characteristics duration, pain fatigue and the domains of the POMS ($n = 95$).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dimension of IPQ-R-S																				
1. Identity																				
2. Timeline (acute/chronic)	0.28#																			
3. Consequences	0.41#	0.33#																		
4. Personal control	−0.21⋆	−0.31#	−0.16																	
5. Treatment control	−0.23⋆	−0.51#	−0.34#	0.48#																
6. Illness coherence	−0.39#	−0.35#	−0.26⋆	0.42#	0.48#															
7. Cyclical timeline	0.34#	0.33#	0.18⋆⋆	−0.12	−0.28#	−0.25⋆														
8. Emotional representation	0.31#	0.37#	0.44#	−0.21⋆	−0.41#	−0.37#	0.26#													
Attributions																				
9. Psychological attribution	0.30⋆	0.02	−0.05	0.09	−0.08	−0.09	0.29#	0.20⋆⋆												
10. Risk factor attribution	0.19⋆⋆	0.10	−0.08	0.06	−0.05	−0.10	0.29#	0.13	0.55#											
11. Immune attribution	0.10	0.03	−0.01	0.04	−0.07	−0.05	0.11	0.08	0.56#	0.58#										
12. Accident or chance attribution	0.12	0.06	0.22⋆	−0.01	0.06	−0.01	−0.05	0.13	−0.19	−0.10	0.04									
13. Sport-specific attributions	0.11	−0.04	−0.19⋆⋆	0.16	−0.01	−0.04	0.16	0.03	0.57#	0.58#	0.50#									
Injury characteristics																				
14. Duration of injury	0.02	0.3#	−0.01	−0.01	−0.02	0.07	0.05	0.02	−0.24⋆	−0.17	−0.12	0.12	−0.07							
15. Pain in daily life	0.38#	0.10	0.22⋆	−18⋆⋆	−0.18⋆⋆	−0.14	0.30⋆	0.15	0.20⋆⋆	0.11	0.13	0.03	0.15	0.01						
16. Fatigue in daily life	0.38#	0.25⋆	0.40#	0.29#	−0.25⋆	−0.15	0.24⋆	0.27#	0.16	0.04	0.14	0.13	0.06	0.12	0.54#					
POMS																				
17. Depression	0.33#	0.37#	0.41#	−0.23⋆	−0.32#	−0.21⋆	0.21⋆	0.68#	0.29#	0.16	0.09	0.08	0.08	0.02	0.13	0.18⋆⋆				
18. Anger	0.41#	0.23⋆	0.31#	−0.07	−0.25#	−0.15	0.20⋆⋆	0.61#	0.35#	0.26⋆	0.18⋆	0.06	0.23⋆	0.08	0.19⋆	0.17⋆⋆	0.77#			
19. Fatigue	0.44#	0.27#	0.29#	−0.17	−0.22	−0.26⋆	0.28#	0.48#	0.47#	0.21⋆	0.15	−0.03	0.16	0.02	0.18⋆	0.39#	0.67#	0.60#		
20. Positive mood vigour	−0.23⋆	−0.22#	−0.26	0.20	0.13	0.12	−0.05	−0.31#	−0.01	0.08	0.05	−0.07	0.14	−0.17⋆⋆	−0.06	−0.31#	−0.37#	−0.30#	−0.44#	
20. Tension	0.30#	0.19⋆⋆	0.36#	−0.13	−0.26#	−0.10	0.27#	0.59#	0.34#	0.16	0.14	−0.03	0.10	0.05	0.16	0.21⋆	0.80#	0.70#	0.60#	−0.12

⋆⋆$p < 0.1$; ⋆$p < 0.05$; #$p < 0.01$.

Table IV. Backward regression analyses for injury variables duration, pain and fatigue.

	β	SE	R^2	t value	P	95% CI	
Variables						Lower	Upper
Duration			0.13				
Constant	25.76	25.61		1.01	0.32	−15.12	76.63
Timeline acute—chronic	3.83	1.18		3.25	0.00	1.48	6.16
Psychological attribution	−4.18	1.77		−2.36	0.02	−7.71	−0.66
Pain			0.17				
Constant	2.75	0.60		1.6	0.00	1.57	3.93
Gender	−0.83	0.47		1.7	0.08	−1.78	0.10
Identity	0.53	0.14		3.7	0.00	0.25	0.81
Fatigue*			0.31				
Constant	3.74	1.70		2.20	0.03	0.36	7.11
Identity	0.31	0.16		1.98	0.05	0.00	0.63
Consequences	0.14	0.06		2.37	0.02	0.02	0.26
Personal control	−0.11	0.05		−2.10	0.04	−0.21	−0.01
POMS depression	−1.13	0.57		−1.99	0.05	−2.26	0.00
POMS positive mood vigour	−0.80	0.34		−2.36	0.02	−1.48	−0.13
POMS tension	0.89	0.53		1.69	0.09	−0.16	1.94

*without POMS fatigue in the regression analyses.

in Table IV. The duration of the injury was related to a chronic timeline and negatively related to psychological attributions. Pain was significantly related to gender and the identity domain. Fatigue was positively related to identity, consequences, POMS tension, and negatively to personal control, POMS depression and positive mood.

In the last question of the IPQ-R-S, athletes were asked to list a maximum of three causes for their injury in an open-ended question. These causes were divided into internally attributed (45%) and externally attributed causes (55%). Internally attributed causes were 'overuse' (51%) (overtraining, trained too long or too intensive), 'my own behaviour' (45%) ('being too fanatic, don't listen to body signals, restart training too soon after injury, not enough rest'), and psychological causes (4%) ('stress or being tense'). Externally attributed causes were 'trauma-related' (14%) (contact with an opponent), sport-related causes (34 %) (shoes, bad technical skills, field, trainer or training programme), bad luck, or an accident (23 %), and specific causes in 29% (blood circulation problems, result of an old injury, sleep posture, heredity, body posture, inadequate medical interventions, the weather, joint laxity, instability).

Discussion

The primary aim of the study was to examine the relation of illness perceptions and mood states to sports–injury variables. Injured athletes were shown in this study to have a weak illness identity, associated with a high controllability. They see their injury as not chronic, and with minimal serious consequences. They understand the nature of their injury according to high illness coherence and do not have a strong emotional representation.

A weak illness identity means that injured athletes do not attribute many of their complaints to their injury. This is a major difference compared to patients with diseases, such as fibromyalgia [12] or Huntington [11]. Injured athletes experience minor consequences in daily life and the consequences for their overall well-being are usually low; they are positive about personal and treatment control. The IPQ-R items, however, do not assess sport-specific consequences but consequences for daily life, in relation to others, and financial consequences. Important consequences for athletes, especially for elite athletes, are probably related to sports participation such as not being able to train, not being able to participate in games or championships or feeling left out of the team.

Athletes with a long lasting injury experience a more chronic timeline and attribute less psychological factors, such as stress, anxiety and worry as cause of their injury (Table IV). This is an interesting result. Healthcare professionals seem to relate long lasting injuries to more psychological factors while athletes seem to deny the involvement of psychological factors. Overall, the psychological attributions and emotional representations of injured athletes are low; of the self-described causes only 4% were psychologically oriented. Emotional responses, e.g. tension, anger, depression, frustration, boredom to athletic injury are related to negative illness perceptions and a negative treatment compliance [5,19,20]. Ponzer et al. [27] described how age, severity of the injury and signs of depression were related to a negative functional outcome after 12 months. From the results

of our study, we can conclude that athletes overall have positive illness perceptions and the psychological responses to an injury are adequate.

Pain is the most frequently experienced symptom in injured athletes. Pain is related to gender, as in other studies concerning pain: female patients report higher pain scores. These gender differences in the experience of pain probably arise from differences in the experience of emotions [28]. Pain and fatigue are both significantly related to the identity scale, meaning that patients who experience more pain and fatigue also experience more other disease-related symptoms, such as loss of strength or weight gain. Pain and fatigue are highly inter-correlated as was found in several other diseases. Athletes with fatigue experience more negative consequences of the injury in daily life and experience less personal control than athletes with no complains of fatigue. This indicates that these patients will make a stronger appeal on healthcare professionals. Severe fatigue is an indication of a negative mood state in injured athletes; they have a less positive mood vigour and feel more tense.

Illness perceptions are related to mood states as reflected by Leventhal's CSM. This is confirmed by the findings of this study; the IPQ-R-S shows a strong relation with the POMS-dimensions especially the emotional representation.

Compared to patients with chronic fatigue and rheumatoid arthritis, [29] athletes perceive fewer symptoms, experience their injury to be less chronic, less cyclical, they experience fewer consequences and have more personal and treatment control. According to the findings of the meta-analysis of Hagger and Orbell [10], the high controllability found in athletes is significantly associated with cognitive reappraisal, expressing emotions and problem-focused coping strategies. The fact that athletes perceive their injury as controllable and curable is related to adaptive outcomes of psychological well-being, social functioning and vitality. Overall, athletes exhibit problem-focused coping to a strong degree. Maybe an important research question is whether they are too active despite the injury or even deny their injury. An additional research suggestion follows from our study: do athletes have minor psychological consequences from injuries or are they denying psychological influences? Especially long lasting injuries must have a major impact on the psychological well being of athletes.

What is the value of assessing illness perceptions in daily practice of sports medicine especially when the illness perceptions of athletes are mostly positive? Illness perceptions are important in understanding behavioural coping strategies of injured athletes. Specifically in cases of insufficient somatic attributions as mentioned in the open-ended questions, such as blood circulation problems or the weather, illness perceptions can interfere with treatment and disability [29]. If the illness perceptions of the injured athlete differ from the sports physicians or sports physical therapists, education or reconceptualisation of inadequate illness perception is important before starting treatment. Agreement about the cause of the injury and the treatment will increase the chances of recovery [29]. Athletes with negative cognitive appraisals of the injury will experience more emotional disturbances and the treatment adherence of these athletes will be worse [18]. In the clinical practice these appraisals should be discussed to increase motivation for treatment. If athletes mention internally attributed causes for their injury, such as 'overuse' or 'my own behaviour' then sports physicians and sports physical therapists have the responsibility to prevent them from making the same mistakes.

The knowledge of the persistence of injuries has been changed in the last decade, especially in the field of tendinopathy. A tendinopathy used to be associated with paratendinitis but in the last decade this diagnosis is no longer used and several hypotheses have been advocated focusing on a failing healing response [30]. The persistence of pain can be caused by ongoing nociception or inflammation, psychological factors (somatisation disorder, anxiety, illness perceptions) or neuropathic pain as a consequence of changes in the nervous system or a combination of these three factors [31]. Therefore especially in the treatment of long lasting injuries the assessment of illness perceptions, psychological factors and behavioural coping strategies can be useful in understanding the injury and can provide new treatment possibilities.

The IPQ-R-S in injured athletes probably needs adjusting. First, it should be adjusted to sport-specific perceptions. In contrast to many (chronic) diseases in which patients often have to be activated, the group of injured athletes also contains a group of 'over users'. Over users are athletes with insufficient coping mechanisms who find it hard to slow down. These athletes might have specific illness perceptions, such as 'it is difficult for me to take rest', 'if I do not play someone will take my place', 'I regularly ignore pain' or 'I have to achieve my goals'. These specific illness perceptions for athletes should be integrated into the IPQ-R-S to make the IPQ-R-S more sports specific. Furthermore, adjustments can be made for specific stages of return to sports during rehabilitation, especially the stage of return to sports comes with specific perceptions. Adjusting the IPQ-R to specific patient groups makes it more valuable for clinical use.

A weakness of this study was the cross-sectional study design and response rate of 67%. This response

may have introduced a selection bias; athletes with positive illness perceptions and positive mood vigour might have been more willing to participate in the study. Athletes were recruited from physical therapy departments or private practices. Treatment can influence illness perceptions and therefore these findings can not be generalised to injured athletes who do not receive any medical attention. Furthermore, we did not assess if athletes where recreational or competitive athletes; this could be an interesting variable to measure in further research.

A major strength of our study is that the study included a broad sample of athletes from different sports and with different injuries. This is in contrast to the study of Hagger et al. [6] that only included undergraduate students or the study of Daly et al. [18] that included patients after knee-surgery. This is the first study investigating illness perceptions and mood states in relation to injury-related outcome.

The clinical use of illness perceptions and the IPQ-R should be further investigated. Outcome variables in the domain of objectively observable behaviours (e.g. return to previous levels of sports activities, sports specific consequences, use of pain medication, etc.) should be incorporated into those studies in order to examine the potential predictive power of illness perceptions and mood states in explaining variation in these and other outcome measures. This would also open the door to controlled intervention studies where illness perceptions are addressed, changed and examined for their role in predicting changes in outcome measures.

We conclude that the findings of this study suggest that the CSM can be a useful framework to understand the perceptions and emotions regarding injured athletes. The model must be adapted for sport-specific use in order to have clinical consequences: clinicians can incorporate patients' views into their medical management in order to increase the concordance between patient's and clinician's perceptions of the injuries, which would be instrumental in optimising outcome.

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