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34

Sport Injuries and Psychological Sequelae

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Although definitions of sport injuries are wide ranging, sport injuries broadly defined encompass bodily tissue damage and functional impairments that have occurred as consequences of sport-related activities, such as training, competition, and recreational participation (Timpka et al., 2015). In addition to limiting performance and physical capacities, these injuries affect the mental health and well-being of athletes across all ages, ability levels, and sport types (Wiese-Bjornstal, 2019b). Psychological sequelae subsequent to sports injuries refer to the psychological results or consequences of those sport injuries. Although sequelae is often used as a term to refer to maladaptive conditions or negative consequences following and related to disease or injury, sequelae also encompasses positive consequences concomitant to health events. After sport injuries, for example, negative psychological sequelae may include anxiety, depression, and loss of confidence, while positive psychological sequelae may comprise stress-related growth, renewed motivation, and a greater appreciation for good health (Podlog, Heil, & Schulte, 2014; Wadey, Podlog, Galli, & Mellalieu, 2016; Wiese-Bjornstal, 2019b).

Discussing sport injuries and their psychological sequelae is part of a larger field of study called sports medicine psychology (Wiese-Bjornstal, 2014). Sports medicine psychology encompasses theory, research, and professional practice concerning the psychological, behavioral, and social aspects of injury prevention and rehabilitation among physically active participants (Wiese-Bjornstal, 2014). Postinjury psychological sequelae encompass many different psychological (e.g., cognitive appraisal), psychiatric (e.g., mental health), and social (e.g., social influence) constructs and processes (Wiese-Bjornstal, White, Russell, & Smith, 2015). Diverse and complex intersections between psychological and biological factors influence these sequelae and outcomes related to physical and mental health. The importance of understanding sport injuries and psychological sequelae, then, attributes to a need to hold athlete health as foremost for those professionals such as sport psychologists, sport coaches, and sports medicine providers that work with and care for athletes, and for researchers who seek to contribute to a knowledge base that supports these areas of professional practice.

Thus, the purpose of this chapter is to overview literature on theory, research, and intervention encompassing both negative and positive psychological sequelae subsequent to sport injuries in a way that provides grounding for theory-driven research and evidence-based practice for sport psychologists, sport coaches, and sports medicine providers. The first section of the chapter provides foundational definitions and incidence metrics related to sport injury surveillance and outlines several of the sport injury specific and general psychological theories that have guided research on the psychological sequelae of sport injuries. In the second section, a schematic of a sport injury lifespan frames an overview of research literature on psychological risk factors and sequelae before, during, and after sport injuries. The third section of the chapter highlights professional practice strategies by describing psychological assessments measuring sport injury sequelae and by identifying evidence-based intervention strategies used by sport psychologists, sport coaches, and sports medicine providers. The fourth section of the chapter summarizes and draws conclusions about the status of research and professional practice related to sport injuries and psychological sequelae.

Sport Injuries and Theories of Psychological Sequelae

Sport injuries are, for most athletes, unexpected stressful life events that present physical and psychological challenges to manage and overcome. In order to provide background for interpreting research on

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the psychological sequelae associated with sport injuries and the psychological interventions used to address them, it is essential to first define sport injuries. Then, with those definitions in mind, the next step is to overview conceptual models and theories used to frame research and clinical practice in sports medicine psychology as a means of leading into discussion of research examining the psychological sequelae of sport injuries.

Sport Injury Definitions

As sport injuries are the events triggering psychological sequelae described in this chapter, it is important to provide a basic definition and understanding of their characteristics. Sport injuries involve bodily tissue damage and/or functional impairments that occur as consequences of engagement in physical activities such as competitive or recreational sport, exercise, dance, or outdoor recreation. Beyond this broad definition, however, many specific aspects of the definition are important to consider in understanding their psychological sequelae. One of the problems in understanding psychological sequelae is that the literature in sports medicine psychology overall lacks consistency and rigor in defining sport injuries, which limits the ability to draw comparisons across studies (Wiese-Bjornstal, 2010). Similar problems are evident in the sports medicine literature on injury epidemiology and surveillance (Timpka et al., 2015). To provide a common understanding, large-scale studies looking at intercollegiate and high school athletics have often adopted definitions of sport injury that require the presence of three characteristics in order for an event to be recorded as a sport injury (Kerr et al., 2014, 2015). A sport injury must have: (1) been sustained during sport activities, and (2) involved medical evaluation or care, and (3) resulted in limitations or alterations in sport behavior, such as loss of time from training or competition or constraints or other modifications to sport activity (Kerr et al., 2014, 2015). Although these specific high school and collegiate injury surveillance systems are specific to organized, competitive sport, injuries occur in a wide variety of other physical activity contexts as well. Thus, the term "sport" as used in this chapter reflects a broad term encompassing not only organized, competitive sport, but also other forms of physical activity for health, performance, or training such as exercise, outdoor recreation, dance, or military physical training. By extension, the term "sport injuries" as used in this chapter encompasses injuries across these various physical activity domains, and "athletes" is inclusive of diverse groups of physically active participants.

Some of the many sport injury epidemiology and surveillance characteristics are incidence, onset, frequency, severity, and type (Wiese-Bjornstal, 2010). Incidence refers to the occurrence of an injury (yes/no), or the actual number of injuries that occurred during the overall time period under investigation. With respect to injury onset, Flint (1998) described two forms: macrotrauma and microtrauma. Macrotrauma injuries occur due to singular impacts or forces (e.g., sprains, dislocations, fractures), while microtrauma injuries occur due to accumulative small forces over time (e.g., shin splints, tendonitis, stress fractures). Injury frequency provides an accounting of how often athletes were injured during a specific time frame (e.g., two distinct acute injuries), and sometimes indications of injury duration or recurrence (e.g., transient, chronic, recurrent) (Wiese-Bjornstal, 2010). Injury severity is commonly examined from a time loss perspective, such as classifying injuries as minor (e.g., 1– 7 days), moderate (e.g., 7—21 days), or severe (e.g., more than 21 days) based on days of sport training or competition lost due to injury (Flint, 1998). Injury types may reference bodily locations of injuries and the nature of the damage, such as head-concussions or head-skull fracture, and knee-anterior cruciate ligament (ACL) tear or knee-medial collateral ligament sprain (Wiese-Bjornstal, Franklin, Dooley, Foster, & Winges, 2015). Medical grading systems capture intersections between severity and type and reflect diagnoses that are contingent upon the extent of tissue damage and associated functional loss as a means of classifying injury types and severities (Flint, 1998).

Other characteristics of sport injuries often reported in sport injury epidemiology and surveillance literature could be of benefit in understanding the psychological sequelae of sport injuries. For example, injury risk, in the statistical sense, refers to the percentage of subjects injured out of the larger sample (Hopkins, Marshall, Quarrie, & Hume, 2007). Injury risk difference expresses a percentage difference and injury risk ratio a likelihood comparison between groups. A limitation of injury risk is that it does not control for exposure time, which refers to the amount of time athletes expose themselves to risk via participation in a specific number of trainings, practices, or competitions (Hopkins et al., 2007). Sport injury rate calculations address this limitation because they involve dividing the number of injuries by the total exposures during practices or contests, resulting in statistics often expressed as injuries per 1,000 or 10,000 athlete-exposures (A–Es). One athlete-exposure usually refers to one athlete participating in one practice or competition (Kerr et al., 2015).

Although evidence of the use of these different characteristics, particularly statistical calculations of injury risks and rates, is somewhat limited in sports medicine psychology research, their use is prevalent in the sport injury surveillance and epidemiology literature. They provide information on the public health aspects of sport

injuries and a means of comparing the relative riskiness of sporting activities by a variety of sociodemographic factors such as sport type (e.g., basketball versus swimming), sport context (e.g., training versus competitions), athlete gender (e.g., females versus males), or level of play (e.g., recreational versus elite). It would be useful moving into the future for sports medicine psychology literature to be more consistent and rigorous in defining sport injuries to allow for comparisons across psychological sequelae investigations.

Theories About Sport Injuries and Psychological Sequelae

A number of conceptual models and theories have provided frameworks for examining sport injuries and psychological sequelae, including sport injury-specific models as well as general psychological theories applied to sport injury rehabilitation contexts. What follows in this section is a brief overview of the most prominent of these conceptual frameworks in terms of their specific relevance to the psychological sequelae of sport injuries.

Sport Injury-Specific Models of Psychological Sequelae

Sport injury-specific conceptual models have provided the predominant impetus for research in sports medicine psychology and clinical practice in sport psychology and sports medicine. They are largely operational models that derive concepts and predictions from earlier psychological theories and schematize how those concepts and predictions would play out within sport injury rehabilitative settings. Seven sport injury-specific models are next described: grief models (Pedersen, 1986; Rotella & Heyman, 1986), affective cycle of injury (Heil, 1993), integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal & Smith, 1993), integrated rehabilitation model (Flint, 1998), biopsychosocial model of sport injury rehabilitation (Brewer, Andersen, & Van Raalte, 2002), disablement in the physical active model (Vela & Denegar, 2010b), and the decision-based model of return to play in sport (Creighton, Shrier, Shultz, Meeuwisse, & Matheson, 2010). This segment presents these models in chronological order based on their emergence.

Grief Models Pedersen (1986) and Rotella and Heyman (1986) presented clinical grief models adapted to the context of psychological responses to sport injuries. The thinking was that since perceived loss precipitates grief, losing the ability to compete in sports, even if temporarily, might trigger grief reactions. These early adaptations of grief models to emotional responses to sport injuries focused on stage-based grief processes, such as shock, denial, reorganization, and acceptance. Evans and Hardy (1995) articulated the concept of grief as derived from the clinical psychological literature, and summarized the research on grief models and constructs as applied to sport injuries. They concluded that while constructs and depictions involving a sense of loss and the emotions associated with grief were indeed relevant to understanding psychological responses to sport injury, empirical support was generally lacking due to several methodological limitations. However, grief models did highlight the importance and centrality of perceptions of loss and grief-like emotional responses in ways that informed subsequent models of sport injuries and psychological sequelae, and some researchers have continued to use grief models as a conceptual framework for research in sports medicine psychology (van der Poel & Nel, 2011).

Affective Cycle of Injury In his edited book *Psychology of Sport Injury*, Heil (1993) introduced an affective cycle of injury model extended from some of the premises of grief models. Described as an "alternative to stage theory" (Heil, 1993, p. 36), the affective cycle of injury encompassed three components: distress, denial, and determined coping. Distress encompassed many of the emotional consequences of sport injuries, such as anxiety, depression, and helplessness. The component of denial represented "a sense of disbelief as well as varying degrees of outright failure to accept the severity of injury" (Heil, 1993, p. 37). Determined coping represented adaptive forms of coping, such as acceptance of the injury and the "purposeful use of coping resources" (Heil, 1993, p. 37) during rehabilitation and recovery. Heil described the affective cycle of injury as an important part of a holistic frame of reference regarding the psychological aspects of sport injuries, a view which also includes considering cognitive, behavioral, and pain factors. Although this model is rarely used as an explicit conceptual framework guiding research design, the ideas conveyed by the model have proven useful not only for clinical practice, such as among psychologists and sports medicine providers working with injured athletes, but also for the advancement of other conceptual models of psychological responses to sport injuries.

Integrated Model of Psychological Response to the Sport Injury and Rehabilitation Process Another of the early postinjury conceptual models guiding research and clinical practice was the integrated model of psychological response to the sport injury and rehabilitation process (Wiese & Weiss, 1987; Wiese-Bjornstal & Smith, 1993; Wiese-Bjornstal, Smith, & LaMott, 1995; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). Figure 34.1 shows a contemporary adaptation of this model (adapted

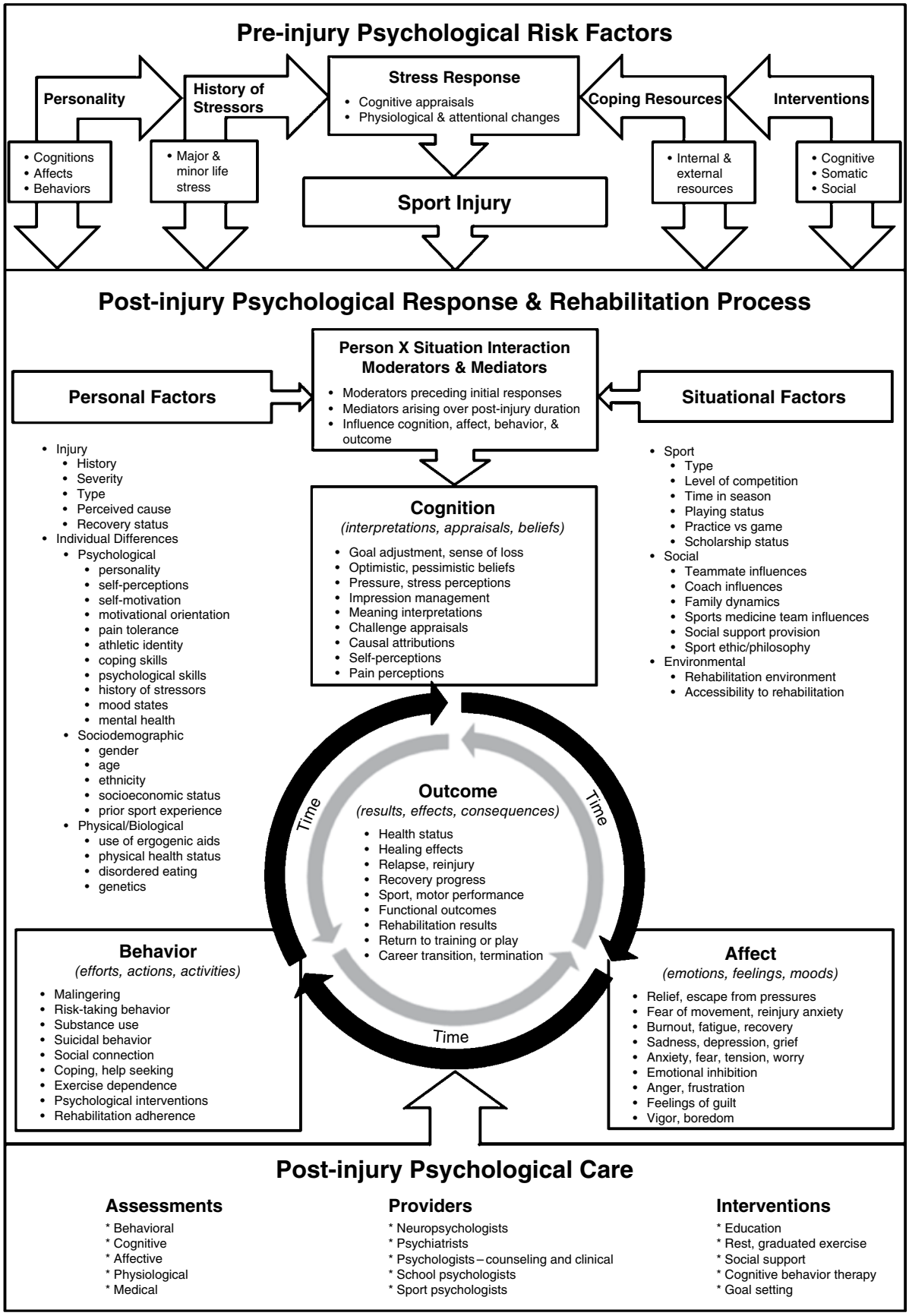

Figure 34.1 Integrated model of psychological response to the sport injury and rehabilitation process. Adapted from "An integrated model of response to sport injury: Psychological and sociological dynamics," by D. M. Wiese-Bjornstal, A. M. Smith, S. M. Shaffer, & M. A. Morrey, 1998, *Journal of Applied Sport Psychology, 10*, p. 49. Copyright 1998 by the Association for Applied Sport Psychology. Reproduced with permission of Taylor and Francis.

from Wiese-Bjornstal et al., 1998). The flow of the model begins with preinjury psychological elements derived from the stress and injury model (Williams & Andersen, 1998) that will continue to exert influence on postinjury sequelae, including the role of personality factors, life-stress factors, and internal and external coping resources. Once sport injury occurs, moderating and mediating factors frame an interactional approach to understanding the dynamic field of personal (i.e., injury and individual differences), and situational (i.e., sport, social, and environmental) influences on cognition, affect, and behavior based on predictions from field theory (Lewin, 1939; Wiese-Bjornstal et al., 1995). The core dynamic cycle derives from the transactional theory of stress in which perceived stress occurs as a process of transaction, or exchange, between the person and the environment (Lazarus & Folkman, 1987). These dynamic cycles reflect bidirectional relationships among cognition, affect, and behavior. Cognitive appraisals refer to various cognitions associated with appraising beliefs and perceptions about the causes and consequences of injuries. These cognitive appraisals influence emotional responses to sport injuries, such as fear, depression, or grief. In turn, behavioral responses, such as rehabilitation adherence or malingering, result from cognitions and emotions, and these influence new cognitive appraisal cycles. In the center of the integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998) are the physical and psychological recovery outcomes affected by these dynamic processes of cognition, affect, and behavior over time. Wiese-Bjornstal et al. (1995) described the model as an operational model designed to guide sport psychologists and sports medicine providers in clinical practice, as well as researchers in their design of sports medicine psychology studies.

Integrated Rehabilitation Model The integrated rehabilitation model (Flint, 1998) provided a biopsychosocial approach to understanding intersections among physical healing processes, psychological sequelae, sport factors, and psychological interventions. The integrated rehabilitation model described phases of physical injury and healing as taught in athletic training education programs and tied them into psychological events and constructs that may arise in conjunction with these healing phases. Flint's physical injury and healing phases included the structural tissue damage of the injury, inflammatory reaction phase, fibroblastic/regeneration and repair phase, tissue maturation and sport-specific phase, and discharge parameters for return to play. In her model, Flint linked structural tissue damage to psychological and emotional responses (e.g., cognitive appraisals and emotions) to psychological skills and strategies, and to the psychological aspects of return to play. The tissue healing phases and the psychological and emotional responses are also connected to sport responses (e.g., social support, team interactions, sport skills). Thus, the integrated rehabilitation model (Flint, 1998) provided an interdisciplinary or biopsychosocial perspective illustrating the influences of physical healing on psychological responses to sport injuries. It has been used as a guide to professional practice in sport psychology (Wiese-Bjornstal, Kenow, & Flint, 2012), sport coaching, and sports medicine, and in informing and educating other sports medicine researchers about the importance of conjunctively considering biological and psychological factors.

Biopsychosocial Model of Sport Injury Rehabilitation The biopsychosocial model of sport injury rehabilitation provides a conceptual framework for understanding the psychological aspects of sport injury rehabilitation (Brewer et al., 2002). The basic premises of Brewer et al.'s model derive from a biopsychosocial approach used as an integrative framework in many areas of medicine as well as in clinical and health psychology (Engel, 1977, 1980). Brewer et al. presented this framework as an extension of, rather than substitute for, models such as the integrated rehabilitation model (Flint, 1998) and the integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998). The basic premise of a biopsychosocial approach is that interactions between psychological and social factors influence biological state or physical status (Engel, 1980). Components of Brewer et al.'s model included the influences of injury characteristics and sociodemographic factors on biological (e.g., endocrine, metabolism), psychological (e.g., personality, cognition), and social/contextual factors (e.g., social network, life stress). These in turn affect intermediate biopsychosocial outcomes such as range of motion, strength, and pain, which next influence sport injury rehabilitation outcomes such as functional performance and quality of life. Implications of the biopsychosocial model of sport injury rehabilitation according to the authors include its "heuristic value in guiding research studies and practical applications" (Brewer et al., 2002, p. 50).

Disablement in the Physically Active Model Vela and Denegar (2010b) created a disablement in the physically active model to represent the disablement process following musculoskeletal sport injuries. Their basic framework derived from earlier literature on disablement models arising from sociological scholarship in the 1960s. These earlier disablement models relied on evidence-based clinical practice findings from several medical professions such as physical and occupational therapy

(Snyder et al., 2008). In developing their disablement in the physically active model, Vela and Denegar (2010b) extended medical disablement models into sport injury contexts via research involving interviews with physically active adults recovering from orthopedic injuries. Their resulting disablement process in sport injuries led to the identification of four disability components: impairments, functional limitations, disability, and quality of life. Quality of life represented psychological problems such as uncertainty and fear, stress and pressure, mood and frustration, overall energy, and altered social relationships. Vela and Denegar (2010a) also developed an accompanying measurement instrument, the Disablement in the Physical Active Scale, as a self-report tool for the assessment of these four disability components. They suggested that their model is useful in guiding clinical practice and research on sport injuries.

Decision-Based Model of Return to Play in Sport The decision-based model of return to play in sport designed by Creighton et al. (2010) is for clinical use by sports medicine providers. The model derived from their review of literature, and guides individualized decision-making processes about return to play decisions made by sports medicine providers. Although not designed as a psychological model, it encompasses several psychological determinants of readiness for return to play as part of clinical decision-making. The decision-based model of return to play in sport involves evaluations within three steps: health status, participation risks and sport risk modifiers, and decision modifiers. Step 1, evaluation of health status, includes assessing biological, psychological, and functional recoveries. The evaluation of health status influences Step 2, considerations of participation risks and sport risk modifiers (e.g., type of sport, position played). Steps 1 and 2 are both part of the risk evaluation process that leads to a consideration of Step 3, decision modification. Decision modification means that certain external decision modifiers (e.g., timing and season, conflict of interest) may change or influence the final determination of return to play but only within the decision-making context of risk evaluation. Creighton et al. explained this in the following way: "participation risk does not contribute information about decision modification, and decision modification cannot be used to determine RTP [return to play] except in the context of knowing participation risk" (p. 380). Psychological aspects of the model are evident among all three steps, such as in the evaluation of health status (e.g., psychological state), evaluation of participation risks (e.g., competitive level and therefore intensity and style of play), and decision modifiers (e.g., pressures from athlete, coach, or family).

General Psychological Theories Applied to Sport Injury Sequelae

In addition to the seven sport injury-specific conceptual models just described, general psychological theories have guided the understanding of postinjury sequelae. Two of these include self-determination theory (Deci & Ryan, 2000) and protection motivation theory (Rogers, 1975), as next described.

Self-Determination Theory Self-determination theory (Deci & Ryan, 2000) has served as a theoretical framework for studies examining return to play processes among injured competitive athletes. Self-determination theory relates to personality and motivation in social contexts such as sport injury rehabilitation. Podlog, Dimmock, and Miller's (2011) review of literature on the psychological aspects of return to play following sport injuries identified several common themes including reinjury, performance, social, and self-presentation concerns. Podlog et al. interpreted these concerns as consistent with self-determination theory, in that athletes' concerns reflected their basic needs for competence, autonomy, and relatedness. Podlog et al. (2013) found among adolescent athletes that the competence and relatedness needs were most salient. Chan, Hagger, and Spray (2011) integrated self-determination theory (Deci & Ryan, 2000) with the theory of planned behavior (Ajzen, 1991) to develop a transcontextual model of treatment motivation based on self-determination theory. The theory of planned behavior links attitudes with behavioral intentions and actual behaviors and has been used to frame the study of a variety of health behaviors such as rehabilitation adherence. Chan et al.'s study (2011) supported predictions of the transcontextual model in treatment motivation. Their study of recreational and professional athletes with moderate to severe sport injuries showed a transfer of autonomous motivation between sport and rehabilitation in that greater autonomous motivation in sport generally was associated with higher autonomous motivation in injury rehabilitations as well.

Protection Motivation Theory Protection motivation theory (Rogers, 1975) has provided a framework for predicting behaviors, such as injury rehabilitation adherence. The theory described adaptive or maladaptive coping responses resulting from appraisals of threat and coping consequent to health dangers, such as sport injuries. Taylor and May (1996) designed a sport injury rehabilitation study to test the predictions of protection motivation theory and developed their own athlete self-report survey instrument, the Sports Injury Rehabilitation Beliefs Survey, to capture theoretical constructs. Their findings with a sample of recreational and competitive

athletes from a university-based sports injury clinic supported protection motivation theory in that higher threat appraisals (susceptibility and severity) related to higher behavioral noncompliance. Positive coping appraisals (self-efficacy, treatment efficacy, and rehabilitation value) correlated with compliant rehabilitation behaviors. Greater threat appraisals (susceptibility) were associated with compliance with restricted activity (rest). Brewer et al.'s (2003) findings also supported the prediction of protection motivation theory with respect to adherence to home and clinic-based rehabilitation exercises among competitive and recreational athletes during rehabilitation from reconstructive surgery (ACLR). Using subscales from Taylor and May's (1996) survey and various indices of rehabilitation adherence (e.g., attendance, intensity of effort, and home exercise completion), Brewer et al. found stronger coping appraisal components (i.e., treatment efficacy and self-efficacy) to have greater association with desirable rehabilitation adherence markers than did threat appraisal components (i.e., susceptibility and severity).

Reviewing both sport injury specific conceptual models and general psychological theories underpinning research and clinical practice in sports medicine psychology provides the theoretical groundwork for examining research findings on the psychological sequelae of sport injuries. The second section of this chapter utilizes a temporal approach to understanding psychological sequelae as a process of dynamic and changing thoughts, feelings, and actions across the time course of sport injury recoveries.

Sport Injury Lifespans and Research on Psychological Sequelae

A sport injury lifespan references the psychological duration of a sport injury experience, that is, the time encompassed by psychological responses to sport injury events. This time period includes the preinjury landscape, injury incidence, medical treatment and care, rehabilitation activities, return to play processes, and in some cases sport transitions such as retirement or transfer. Figure 34.2 depicts an emerging sport injury lifespan and psychological sequelae model designed to integrate literature in a temporal way (Wiese-Bjornstal, 2017b). This injury lifespan approach integrates several conceptual frameworks that guided the derivation of key physical and psychological events or processes used to generate a chronological understanding of sport injury. These include the stress and injury model (Williams & Andersen, 1998), integrated rehabilitation model (Flint, 1998), the integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998), and a schematic reflecting the temporal flow of a sport injury lifespan (Wiese-Bjornstal, 2009). Into this lifespan framework are also integrated ideas based on narrative frames underlying illness (Frank, 2007), as these therapeutic or sociological approaches to injury stories provide insightful relevance into psychological sequelae following sport injury. Narrative research methodologies involve systematic, qualitative approaches to using storytelling as a means to capture the totality of an individual's health experience, such as with a sport injury (Sools, Murray, & Westerhof, 2015). Embedded within these stories are the thoughts, feelings, and actions of athletes throughout their recovery periods (Russell & Wiese-Bjornstal, 2016; Smith & Sparkes, 2004; Spencer, 2012).

Thus, the psychological chronology from the preinjury landscape affecting the earliest recognition of injury through possible disengagement from sport due to injury derives from a conceptual assimilation of research literature on physical and psychological healing processes and long-term health consequences. This section of the chapter considers research on psychological sequelae relative to these key physical and psychological events common to many sport injuries.

Preventing Sport Injury

Although the focus of this chapter is on psychological sequelae following sport injury, it is important to discuss first athletes' psychological landscapes prior to sport injuries as these psychological and social influences often continue into the postinjury phase (Wiese-Bjornstal & Smith, 1993). Thus, the first key event phase relative to a sport injury lifespan is preventing sport injury. The Figure 34.2 column below this key event phase characterizes this as a time during which tissue is healthy, the focus of health care is on injury prevention, the injury narrative frame may be one of equilibrium, the psychological sequelae may reflect robustness, and psychological interventions focus on mental toughness, recovery, and stress management.

Into this general landscape of health, then, enters emerging psychological susceptibility and vulnerability to sport injury. According to Wiese-Bjornstal (2019a), psychological susceptibility to sport injury refers to psychological, behavioral, and social risk and protective factors that influence sport injury outcomes such as risk or rate of injury. It encompasses the preinjury aspect of sports medicine psychology (Wiese-Bjornstal, White, Wood, & Russell, 2018).

The predominant theoretical model examining psychological susceptibility to acute sport injury is the stress and injury model (Williams & Andersen, 1998). This model identifies psychological antecedents (personality,

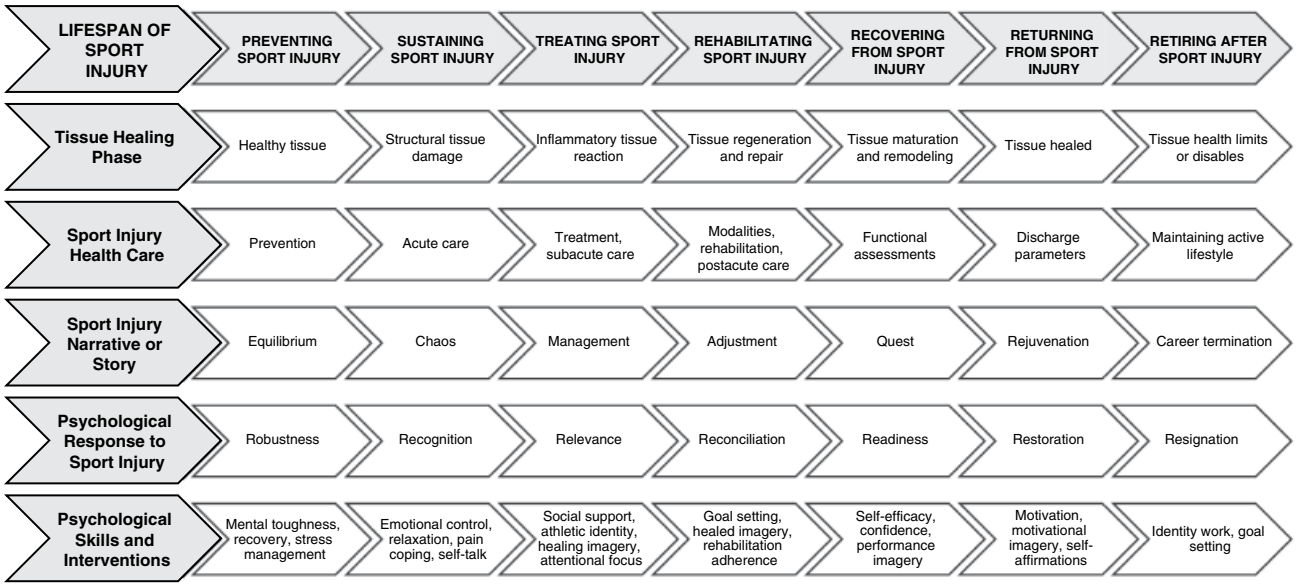

Figure 34.2 Sport injury lifespan and psychological sequelae model (Wiese-Bjornstal, 2017b). Copyright 2017 by D. M. Wiese-Bjornstal. Reprinted by permission of the author.

history of stressors, coping resources) that influence stress responses (manifested via cognitive, attentional, and physiological markers), which in turn influence sport injury risks. Research examining this model has documented the negative effects of life stressors on sport injury risks via the heightened stress reactivity pathway (Ivarsson, Tranaeus, Johnson, & Stenling, 2017). Other psychological risk factors include perceived risk of injury, various forms of anxiety (e.g., trait, illness, pain), and negative mood states (e.g., high fatigue). Behavioral risk factors include risk taking, help-seeking avoidance, and aggression. Social risk factors incorporate pressures from coaches to play when fatigued or ill, media scrutiny, and inadequate social support (Wiese-Bjornstal, 2019a).

Protective factors include psychological, behavioral, and social strategies used in prevention efforts to help athletes minimize, monitor, and manage risks associated with sport injuries. Cognitive behavioral stress management programs, resilience strategies such as mental skills training and proactive coping, applied behavior analysis, assessing and monitoring internal and external stress and recovery levels, and healthy training load management are effective ways to reduce psychological susceptibilities and vulnerabilities to sport injuries (Wiese-Bjornstal, 2019a).

Whether via an acute, traumatic event or graduate cumulative event, this state of health, prevention, and equilibrium may shatter when injuries intrude. Thus, the next key event phase describes the psychological sequelae associated with the emergence of a sport injury.

Sustaining Sport Injury

Figure 34.2 shows that the next key event in a sport injury life span is sustaining a sport injury. The Figure 34.2 column below this key event phase characterizes this as a time during which structural tissue damage is occurring or emerging, when athletes eventually seek acute care, and a chaos narrative of confusion and uncertainty may be evident. The athlete psychologically recognizes and begins to deal with the injury, and important psychological skills could reflect emotional control, relaxation, pain coping, and self-talk.

The nature of injury onset affects recognitions of being injured. As mentioned earlier, since macrotrauma injuries onset with single traumatic events and microtrauma injuries onset with repetitive small traumas over time (Flint, 1998), the recognition of injury emerges over differing temporal periods. Indications of the athlete's thoughts, feelings, and actions at the point of injury recognition for different types of onsets are evident in several longitudinal research studies following athletes' psychological responses over time (Clement, Arvinen-Barrow, & Fetty, 2015; Tracey, 2003). In the case of macrotrauma injuries, depending on the severity, the athletes' immediate recognitions of injuries are reactive or reflexive in response to shock and confusion about what has just happened (Tracey, 2003). Tracey found via concurrent interviews that confusion, shock, uncertainty, and vulnerability were evident among intercollegiate athletes shortly after sustaining moderate to severe injuries. Analyses of retrospective interviews with intercollegiate athletes by Clement et al. also illustrated early psychological reactions to sport injuries, which, similarly to Tracey's findings, included hysteria, anger, shock, upset, and uncertainty.

For microtrauma injuries, there is often doubt about whether the concerning signs and symptoms signal possible injury or merely training pain. It may be unclear to the athlete or coach as to whether it is necessary to seek professional medical evaluation and care; thus, the idea of a chaos narrative involving emotional upheavals and confusion about what to do may be evident (Frank, 2007). For example, Russell and Wiese-Bjornstal (2015, 2016) found during the onset of microtrauma injury among novice marathon runners that the psychological narratives or stories (Frank, 2007) reflected two behavioral themes: self-diagnosis and self-treatment, and not taking time off. These findings reinforce the idea that it can take some time before microtrauma-injured athletes recognize and acknowledge that they are injured and seek treatment from sports medicine providers.

Treating Sport Injury

During the treatment phase of the sport injury lifespan (Figure 34.1), an inflammatory tissue reaction is evident that requires treatment or subacute care. The narrative story may reflect dealing with the management of the new challenges presented by treating the sport injury, while the psychological sequelae may constitute a search for relevance or meaning. Some of the adaptive psychological skills and interventions at this time may include social support, athletic identity, healing imagery, and attentional focus.

Cognitive appraisals involving the search for meaning and relevance could include modifying sport goals and questioning athletic identity (Brewer, Van Raalte, & Linder, 1993) and other self-perceptions (Wiese-Bjornstal et al., 1998). Collinson (2005) noted cognitive themes of optimism, relief, and doubt within the autoethnographies of two middle-aged distance runners. Grindstaff, Wrisberg, and Ross (2010) explored relevance by adopting a phenomenological approach and using inductive analyses to identify meanings assigned to sport injury experiences of five intercollegiate athletes. They conducted repeated interviews across the early phase of rehabilitation experiences for injuries that had a minimum of 30 days of time loss from practices or competitions. Four primary meaning themes emerged from Grindstaff et al.'s interview data: perspective, emotion, coping, and relationships. Perspective themes encompassed seeing

sport injury as an experience that challenged their perspectives on life and sport, such as what was to be learned from the purpose and timing of the injury. The emotion theme included athletes discussing the dynamic, changing nature of emotions and their increasing willingness to share their feelings. Coping themes reflected meanings concerning the importance of accepting injury challenges and overcoming them. The meaning of relationships reflected the relevance of social connection and support to their recoveries.

Affective responses during this time might reflect fears about pain or the rehabilitation process, anger at an unnecessary cause of injury such as unsportsmanlike play, or fatigue associated with managing physical and psychological trauma (Wiese-Bjornstal et al., 2018). As described by Spencer (2012), narratives may reflect perceptions of despair and loss, such as those emerging via ethnographic research among mixed martial arts fighters responding to sport injury, or of despair, anger, and blame, as found by Collinson (2005) in adult distance runners.

Another example of the psychological relevance of sport injury is evident in the longitudinal case study approach adopted by Samuel et al. (2015) in looking at athletes who were recovering from severe injuries. This study provided temporal data about the dynamic nature of psychological changes over sport injury lifespans. Samuel et al. framed their investigation in the context of career change events, events that "disrupt the athletic engagement status quo, create emotional imbalance, and require athletes to respond by generating a matching psychological and/or behavioral change" (p. 100). The three stages of the change process observed by Samuel et al. included the relatively stable and highly motivational preinjury environment, the injury event mostly perceived as inciting significant and negative change, and the implementation of athletes' decisions to change attitudes or actions, generally but not always for the better.

As one of their measures of change, Samuel et al. (2015) incorporated consideration of the sport-specific personality construct of athletic identity (Brewer et al., 1993), which refers to an identification of the self as an athlete. They found that athletic identity affected athletes' self-perceptions across all three stages of change events. Other sports medicine psychology studies have also looked at athletic identity. Brewer and Cornelius (2010) observed declines in athletic identity following surgical repair of ACL injury in a sample of adult athletes, which was especially evident among patients with the slowest recoveries. Brewer et al. (2007) found that athletes with higher levels of athletic identity and lower optimism were more vulnerable to persistent negative moods for the first 42 days following surgery. These findings on athletic identity support that self-perceptions influence interpretations of relevance and meaning, which in turn influence affective responses and behavioral changes.

Rehabilitating Sport Injury

During the rehabilitating sport injury aspect of the lifespan model (Figure 34.1), tissue regeneration and repair characterize the healing process, while modalities and postacute care comprise health care. Athletes' cognitions may reflect restitution narratives or stories (Frank, 2007; Sparkes & Smith, 2011), characterized by a cognitive focus on what one needs to do to restore physical health and capabilities and thus reestablish wholeness and return to sport. Collinson (2005) found narratives related to pain, injury, and emotions, as well as faith, hope, and disappointment, and Roy, Mokhtar, Karim, and Ayathupady (2015) noted that increasingly positive narrative themes emerged for a cyclist while transitioning from rehabilitation to recovery and return.

Mentally, this process reflects reconciliations, or adjustments, moving from the fears, uncertainties, and anxieties often felt during recognition and relevance to the mental toughness and perseverance needed to adapt, adhere, and cope relative to rehabilitation processes. Research supporting the psychological consequences during this time illustrates themes such as adjustment, coping, motivation, social support, and rehabilitation adherence (Granquist, Podlog, Engel, & Newland, 2014; Hutchison, Mainwaring, Comper, Richards, & Bisschop, 2009; Wadey Evans, Hanton, & Neil, 2012).

Some of the prevalent negative emotions or moods that must be reconciled, for example, are fear and anxiety about injury or reinjury (Prugh, Zeppieri, & George, 2012; Wadey et al., 2014), kinesiophobia (Cozzi, Dunn, Harding, Valovich McLeod, & Welch Bacon, 2015), catastrophizing (Parr et al., 2014), negative mood states (Cahalan, Purtill, O'Sullivan, & O'Sullivan, 2015; Van Wilgen, Kaptein, & Brink, 2010), and frustration (Clement et al., 2015). For optimal recoveries, athletes must reconcile negative feelings with more positive or adaptive ways of thinking and feeling, as perceptions of stress and negative affect impede tissue regeneration and repair through their influences on immune system functioning (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002).

Several studies have explored diverse aspects of cognition, affect, and social influence in rehabilitation adherence behavior (Levy, Polman, & Clough, 2008; Levy, Polman, Clough, Marchant, & Earle, 2006; Levy, Polman, Nicholls, & Marchant, 2009). For example, social support is one of the many social influence factors affecting rehabilitation adherence behavior (Levy et al., 2008). One of the cognitive factors affecting rehabilitation adherence is mental toughness. Mental toughness refers

to coping, focus, determination, confidence, and control under pressure (Madrigal & Gill, 2014). Using approaches such as adaptations of the planned behavior model, Levy and colleagues (Levy et al., 2006, 2008, 2009) found that mental toughness can have positive associations with some dimensions of rehabilitation adherence (e.g., attendance) but negative associations with other dimensions of adherence such as quality (e.g., effort, behavior). For example, Levy et al. (2006) found among competitive and recreational athletes that higher self-rated mental toughness was associated with better clinic-based rehabilitation attendance, but lower self-ratings of mental toughness were associated with higher levels of physiotherapist-rated adaptive behaviors during clinic-based rehabilitation sessions. Levy et al. (2006) speculated that one of the explanations for the latter finding might be greater social support provision by physiotherapists to athletes low in mental toughness.

Recovering from Sport Injury

During the model phase labeled recovering from sport injury (Figure 34.1), tissue maturation and remodeling and functional assessments by sports medicine providers characterize the tissue healing and health-care situations. The injury narrative may be a quest to advance oneself physically and mentally, during which athletes are psychologically assessing their readiness for returning to sport as they move toward strengthening physically and mentally in readying themselves for returns to sport. Psychological skills and interventions that might be most relevant during this time would be improving self-efficacy and self-confidence, and the use of performance imagery.

The dynamic nature of psychological adjustments over these rehabilitation and recovery periods is evident in most sports medicine psychology studies (Wiese-Bjornstal et al., 2012). For example, Ruddock-Hudson, O'Halloran and Murphy (2012, 2014) documented dynamic fluctuations in psychological responses to injury in studies among male Australian Rules football players. These dynamic fluctuations are evident in the study by Ruddock-Hudson et al. (2014), in which they report results of interviews with players experiencing time losses ranging from 9 weeks to 10 months across three injury phases: reactions to injury, reactions to rehabilitation, and reactions to return to play. Their results showed that cognitive, affective, and behavioral themes differed across these three phases. With respect to the reaction to rehabilitation phase, Ruddock-Hudson et al. (2014) found themes that reflected a process defined by fluctuating thoughts and emotions, perceived challenges of rehabilitation and social isolation, and positive feelings of support and renewed optimism.

These injury stories during psychological reconciliation may reflect a quest narrative, one of the common illness narratives described by Frank (2007), in which the injured athlete searches for the positives in the situation (Ronkainen, Watkins, & Ryba, 2016; Smith & Sparkes, 2004; Sparkes & Smith, 2011). Frank suggested that quest narratives are about generating new insights in consequence to dealing with illness, which in this case extends to sport injury as the health challenge. A search for the positives is evident in the expanding literature on stress-related growth in the context of sport injury rehabilitation (Salim, Wadey, & Diss, 2015), and is of particular relevance during psychological readiness. Stress-related growth refers to beneficial or positive improvements in functioning resulting from stressful life events such as sport injuries (Wadey et al., 2016), and thus might characterize an increasing state of psychological readiness to return to sport.

Coaches interviewed by Wadey, Clark, Podlog, and McCullough (2013) reported perceptions of four areas of stress-related growth among injured athletes: personal, psychological, social, and physical. Examples of personal growth observed by Wadey et al. included benefits to attitude (e.g., greater sport enjoyment) and knowledge (e.g., raised awareness of injury risk factors), while psychological growth reflected improvements in factors such as confidence, motivation, and coping. Social growth evidenced in strengthening and extending social networks, and physical growth included aspects such as improved core stability and physical strength. Tamminen, Holt, and Neely (2013) found through interviews with elite female athletes that realizing strength through adversity, gaining perspectives on their problems in the wider scope of life, and gaining a desire to help others such as helping them improve sport performance emerged as important areas of growth resulting from experiences of adversity such as injuries. Among the aspects of adversity offering opportunities for growth in their study was social support. Athletes reported feeling isolated and "in a bubble" (Tamminen et al., 2013, p. 33), but benefited when they opened themselves up to support from others such as teammates.

Returning from Sport Injury

The sport injury lifespan and psychological sequelae model (Figure 34.1) shows the returning from sport injury phase as a time during which tissues have healed and athletes have met the medical discharge parameters. In effective returns to play, the narrative story may be along the lines of rejuvenation, and the psychological sequelae restoration, in that athletes are motivated and excited to be able to return to play following recoveries. Relevant psychological skills and interventions may include motivational strategies and self-affirmations.

Specific psychological factors seem to characterize successful returns to play. In a systematic review of psychological factors surrounding return to play following ACL injury, Ardern, Taylor, Feller, and Webster (2013) concluded that high motivation and confidence and low fear were associated with several desirable return to play outcomes. These included faster returns and a greater chance of returning to the same level of play as before the injury. Further, the findings of Ardern et al. supported Podlog and Eklund's (2006) characterization of psychological needs and challenges during return to play as those of competence, autonomy, and relatedness, consistent with self-determination theory (Deci & Ryan, 2000). Specific aspects of returning to play identified by Podlog, Banham, Wadey, and Hannon (2015) included confidence, realistic expectations, and motivation to regain performance standards.

In their own review of the literature on psychosocial factors influencing athlete recoveries and returns to play following ACL surgeries, te Wierike, van der Sluid, van den Akker-Scheek, Elferink-Gemser, and Visscher (2013) found several cognitive, emotional, behavioral, and intervention factors associated with successful recoveries. Cognitively, higher internal health loci of control and self-efficacy facilitated recoveries. Emotionally and behaviorally, lesser fears of reinjury associated with better knee outcomes and returns to play. Among intervention factors, goal setting was related to better rehabilitation adherence, and better rehabilitation adherence was associated with better outcomes of ACL injuries (te Wierike et al., 2013).

Retiring After Sport Injury

In this key event phase, retiring after sport injury (Figure 34.1), tissue health and injury recovery status may have terminated athletes' abilities to continue in their sports. Thus, in the short term they must consider either retiring from their sports or transferring to lower levels or different sports. Even if retiring, athletes would typically be concerned about their abilities to maintain physically active lifestyles after retirement and into the future. Psychologically athletes have to resign themselves to altered futures, and so psychological skills related to identity work and goal setting could be effective strategies for successful transitions.

Sport injuries are among the most prevalent reasons for sport career termination or retirement and also affect long-term disability and physical activity engagement among those retiring for this reason (Ristolainen, Kettunen, Kujala, & Heinonen, 2012; Russell, Tracey, Wiese-Bjornstal, & Canzi, 2017). Both acute and chronic sports injuries can have negative, long-term psychological consequences upon an athlete's quality of life (QOL). For example, former collegiate athletes reported significantly more severe acute and chronic injuries than did nonathletes and reported lower than average ratings than the U.S. population overall in categories of physical functioning and pain interference (Simon & Docherty, 2014). Athletes who have suffered one or more severe musculoskeletal injuries were two to four times more likely to report aversive psychological symptoms, such as difficulty sleeping, alcohol misuse, and distress (Gouttebarge, Aoki, Ekstrand, Verhagen, & Kerkhoffs, 2016). These severe musculoskeletal injuries also leave athletes exposed to future mental health conditions that impair their overall QOL, such as depression (Filbay, Ackerman, Russell, & Crossley, 2017; Filbay, Crossley, & Ackerman, 2016).

Athletes who have suffered severe musculoskeletal and overuse injuries during their athletic careers also have a higher risk of being diagnosed with osteoarthritis later in life (Drawer & Fuller, 2001; Schmitt, Brocai, & Lukoschek, 2004; Simon & Docherty, 2014; Sorenson et al., 2014). Osteoarthritis, also called arthrosis, is a condition usually of the lower extremities (such as a knee or hip), whereby the joints become swollen, stiff, and painful to use (Drawer & Fuller, 2001). The rate of osteoarthritis in former National Collegiate Athletic Association Division I athletes may be as high as 40%, which is significantly higher than the 24% rate among nonathlete populations (Simon & Docherty, 2014). Although exercise has shown positive benefits for an individual's health-related QOL, former athletes may not be able to be as active given their levels of chronic pain and joint stiffness; thus, the chronic pain may have secondary consequences beyond the physical pain itself (Simon & Docherty, 2014). Lingering consequences of sport injuries may compromise future careers and activities of daily living. In a study investigating athletes who retired from sports due to injury, as many as 70% considered themselves permanently mild to moderately disabled, exhibiting high scores on both work- and leisure-related disability (Ristolainen et al., 2012).

In addition to musculoskeletal injuries, short- and long-term psychological consequences are associated with sport-related concussions (SRC). Athletes who have sustained severe musculoskeletal injuries are more likely to sustain SRC, and conversely, athletes who have sustained any number of SRC are more likely to sustain severe musculoskeletal injuries (Pietrosimone, Golightky, Mihalik, & Guskiewicz, 2015). According to Pietrosimone et al., this places athletes into potentially high-risk spirals of SRC and musculoskeletal injuries that could contribute to premature injury-related sport retirements. SRC can also be the cause of both short- and long-term psychological distress for former athletes (Moore, Suave, & Ellemberg, 2015). Even years after their playing careers have ended, SRC sustained during sport careers are

associated with consequences such as depression, suicidal ideation, headaches, paranoia, vision impairments, and more (Caron, Bloom, Johnston, & Sabiston, 2013). Former American National Football League players with a history of three or more SRC were up to three times more likely to report depressive symptoms than were former players without a history of SRC (Guskiewicz et al., 2007). At the extreme end, chronic traumatic encephalopathy (CTE), a neurodegenerative disease in which the brain accumulates excess tau proteins, is evident in the brains of many former athletes (McKee et al., 2016). Repeated head traumas, such as SRC and subconcussive blows, contribute to the development of CTE (McKee et al., 2016). Although at this time it is only possible to diagnose with certainty post-mortem, individuals suspected of having CTE often present with symptoms similar to other traumatic brain injuries (TBI) and dementia (McKee et al., 2017), such as irritability, impulsivity, depression, or cognitive and motor impairment.

The transition from an athletic career to a life of retirement or a different career can difficult. Although often thought of as a single event, retirement comprises a series of challenges that impede a smooth transition, especially for athletes who have prematurely ended their careers due to injury (Taylor & Ogilvie, 1994; Wylleman, Alfermann, & Lavallee, 2004). In a qualitative study using athletes who had to retire from their college careers due to injuries, Stoltenburg, Kamphoff, and Bremer (2011) identified a number of affected psychosocial factors that influenced the transition period. These difficult transitions were somewhat easier when injuries were life threatening; living healthy lives became far more important than playing their respective sports again (Stoltenburg et al., 2011). These transitions were also less difficult when athletes had strong social support networks and groups of friends outside of their teams. These social connections allowed former athletes to assimilate into their other social groups, as opposed to feeling as if they were simply members of teams to which they could no longer contribute (Stoltenburg et al., 2011). Similarly, athletes who had lower athletic identities were able to transition more easily to life outside of sports, as found in other qualitative studies. For example, in Caron et al.'s (2013) qualitative study involving former National Hockey League (NHL) players who left the game due to SRC, they noted that many of these athletes had not known a life outside of hockey. In consequence, they experienced severe social withdrawal, depression, suicidal ideation, and a loss of identity when forced out of the game due to SRC (Caron et al., 2013).

To summarize with respect to research on the psychological sequelae of sport injuries, a lifespan approach aids in understanding the dynamic nature of thoughts, feelings, and behaviors and their role in mental and physical recoveries across time. Although general ideas about the roles of psychological skills and interventions were illustrated in the sport injury lifespan and psychological sequelae model, the next section of the chapter more explicitly presents the evidence-bases for these recommendations.

Assessment and Interventions for Sport Injury and Psychological Sequelae

An understanding of conceptual frameworks and research on postinjury psychological consequences positions sports and sports medicine professionals to consider professional practice implications related to this work. Both researchers and practitioners have provided literature bases and guidelines for the assessment of psychological sequelae following sport injuries, as well as for psychological interventions that may prove effective. This section of the chapter explores these professional practice implications.

Assessment of Postinjury Psychological Sequelae

The assessment of postinjury psychological sequelae is important to researchers as well as those in professional practice. The development of a number of sport-specific measures has advanced the availability of measures tapping into different cognitions, affects, and behaviors associated with psychological responses to sport injury and rehabilitation. Table 34.1 (Wiese-Bjornstal, 2017a) summarizes the key characteristics of and sources for some of these measures. These assessments are largely athlete self-report measures, which come with both strengths and limitations (Saw, Main, & Gastin, 2015). According to Saw et al., strengths of self-report measures include simplicity of administration, cost-effectiveness, and reliable nature, while limitations include validity, measurement error, and conscious bias. A few involve sports medicine-provider reports or structured clinical interview guidelines. McLean et al. (2017) cautioned users about the inadequate psychometrics associated with existing self-report, as well as health-care provider report, measures of rehabilitation exercise adherence relative to musculoskeletal injuries.

Some of these measures were designed for research use but most are such that they could potentially be useful in clinical practice settings as well. The ethics of assessment and the training of the sports-related professional would determine which of these are suitable and appropriate in different contexts. For example, some assessments are clinical intake interviews for sport psychologists (e.g., the Emotional Responses of Athletes to

Table 34.1 Assessments of psychological sequelae following sport injury (Wiese-Bjornstal, 2017a).

Title	Acronym	Format	Measure	Authors	Year
Anterior Cruciate Ligament Return to Sport Inventory	ACL-RSI	Athlete self-report	Confidence, emotions, readiness	Webster, Feller, & Lambros	2008
Adolescent measure of confidence and musculoskeletal performance	AMCAMP	Athlete self-report	Confidence in movement abilities after rehabilitation	May, Guccione, Edwards, & Goldstein	2016
Athlete Fear Avoidance Questionnaire	AFAQ	Athlete self-report	Fear avoidance	Dover & Amar	2015
Athletes' Received Support Questionnaire	ARSQ	Athlete self-report	Social support	Freeman, Coffee, Moll, Rees, & Sammy	2014
Athletic Injury Psychological Acceptance Scale	AIPAS	Athlete self-report	Screen for serious psychological problems	Tatsumi	2013
Attention Questionnaire of Rehabilitated Athletes Returning to Competition	AQ-RARC	Athlete self-report	Functional and distracted attention	Christakou, Zervas, Psychountaki, & Stavrou	2012
Causes of Re-Injury Worry Questionnaire	CR-IWQ	Athlete self-report	Reinjury worry	Christakou, Zervas, Stavrou, & Psychountaki	2011
Disablement in the Physically Active Scale	DPAS	Athlete self-report	Perceived disablement	Vela & Denegar	2010a
Emotional Responses of Athletes to Injury Questionnaire	ERAIQ	Clinical interview	Cognitions, emotions, behaviors, social support	Smith, Scott, & Wiese	1990
Injury Psychological Readiness to Return to Sport	I-PRRS	Athlete self-report	Perceived readiness	Glazer	2009
Psychological Responses to Sport Injury Inventory	PRSII	Athlete self-report	Psychological responses	Evans, Hardy, Mitchell, & Rees	2008
Rehabilitation Adherence Measure for Athletic Training	RAdMAT	Athletic trainer report	Rehabilitation adherence	Granquist, Gill, & Appaneal	2010
Rehabilitation Adherence Questionnaire	RAQ	Athlete self-report	Rehabilitation adherence	Fisher, Domm, & Wuest	1988
Rehabilitation Overadherence Questionnaire	ROAQ	Athlete self-report	Rehabilitation adherence	Podlog, Gao, et al.	2013
Reinjury Anxiety Inventory	RIAI	Athlete self-report	Reinjury anxiety	Walker, Thatcher, & Lavallee	2010
Recovery-Stress Questionnaire for Athletes	REST-Q	Athlete self-report	Recovery and stress	Kellmann & Kallus	2001
Return to Sport after Serious Injury Questionnaire	RSSIQ	Athlete self-report	Motivation to return	Podlog & Eklund	2005
Returning to Sport Survey	RSS	Athlete self-report	Perceived readiness	Wiese-Bjornstal, Arendt, Russell, & Agel	2014
Risk Behavior Conformity in Sport Inventory	RBCSI	Athlete self-report	Risk behaviors	Kenow & Wiese-Bjornstal	2010
Sport Injury Anxiety Scale	SIAS	Athlete self-report	Threat appraisals	Rex & Metzler	2016
Sport Injury Rehabilitation Adherence Scale	SIRAS	Sports medicine-provider report	Rehabilitation adherence	Kolt, Brewer, Pizzari, Schoo, & Garrett	2007
Sports Injury Rehabilitation Beliefs Survey	SIRBS	Athlete self-report	Threat and coping appraisals	Taylor & May	1996
Sports Inventory for Pain	SIP	Athlete self-report	Pain coping	Bourgeois, Meyers, & LeUnes	2009
Tampa Scale of Kinesiophobia	TSK	Athlete self-report	Fear of movement or reinjury	Miller, Kori, & Todd	1991

Injury Questionnaire, ERAIQ, Smith, Scott, & Wiese, 1990). Other measures are self-report surveys that could be useful to sports medicine providers such as orthopedic surgeons (e.g., ACL Return to Sport Inventory, ACL-RSI, Webster, Feller, & Lambros, 2008). Athletic trainers may find assessments of rehabilitation adherence particularly relevant to their work (e.g., Rehabilitation Adherence Measure for Athletic Training, RAdMAT, Granquist, Gill, & Appaneal, 2010). Sport coaches might find it beneficial to monitor athletes for fatigue via the Recovery-Stress Questionnaire for Athletes (REST-Q, Kellmann & Kallus, 2001).

These assessments can provide guidance in targeting and planning interventions based on the psychological needs of the athlete, such as changing thoughts, feelings, and/or actions. The next section identifies some of the psychological interventions used with success within sport injury rehabilitative contexts.

Interventions for Postinjury Psychological Sequelae

Sports medicine professionals that are closely involved in the rehabilitation process, which include physicians, physical therapists/physiotherapists, athletic trainers, sport coaches, strength and conditioning coaches, and sport psychologists, have found psychological interventions to enhance the overall well-being and facilitate injury recovery (Rock & Jones, 2002). Research in the psychological processes after sport injury have identified the most commonly used interventions that have been successful in helping injured athletes cope with injuries and enhance sport performances. This section (1) highlights the frameworks that guide sport professionals in counseling the emotional challenges, mental health concerns, and identity crises of injured athletes, (2) examines interventions commonly used to help athletes cope with injury, (3) discusses interventions which enhance performance during recovery, (4) outlines the need for cultural competence of sport professionals providing care to injured athletes, and (5) identifies the specific roles of sport professionals in providing psychological interventions throughout the postinjury sequelae.

Offering Counseling to Intervene in Sport Injuries and Psychological Sequelae

Nearly three decades of research has been devoted to the counseling needs of athletes, recognizing athletes as a special counseling population (Ward, Sandstedt, Cox, & Beck, 2005). In postinjury psychological sequelae, the focus is on the counseling needs of athletes and the counseling skills necessary of sport professionals providing injury-specific emotional support. Many athletes experiencing sport injury will demonstrate negative emotional reactions or mood disturbances (Ward et al., 2005; Wiese-Bjornstal, 2010). These injury-related psychological reactions can lead to grief, fear, anxiety, loss of identity, depression, low vigor, and burnout (Appaneal, Levine, Perna, & Roh, 2009; Longstaff & Gervis, 2016; Mankad & Gordon, 2010; Ward et al., 2005; Wiese-Bjornstal, 2010; Witt, 2015). Owing to the wide range of psychological consequences to injury, many sport professions have recognized counseling as a part of their professional responsibilities (Ray, Terrell, & Hough, 1999). Ray et al., for example, discussed the counseling skills of sport professionals in terms of psychological helpers, where most sport medicine professionals are considered second-level helpers and provide emotional support to athletes as well as refer greater mental health concerns to more qualified professionals (first-level helpers).

Effective counseling skills used in sport injury contexts involve active listening, effective communication, and guiding injured athletes through appropriate behavioral modifications through decision-making, problem solving, and conflict resolution (Shelley, Trowbridge, & Detling, 2003) with goals of supporting autonomy, improved confidence, and psychological self-regulation of injured athletes (Longstaff & Gervis, 2016; Rock & Jones, 2002). Furthermore, counseling skills can help develop athlete-practitioner relationships that may benefit both physical and mental recoveries (Longstaff & Gervis, 2016).

Wiese-Bjornstal et al.'s (1998) integrated model of psychological response to the sport injury and rehabilitation process provides an effective framework guiding points of intervention throughout the rehabilitation process. Social support and coping resources can affect the cognitive appraisals (perceptions of rehabilitation effectiveness), emotional responses (arousal or mood), and behavioral responses (rehabilitation adherence) of injured athletes (Rock & Jones, 2002). As the rehabilitation process is undergoing continuous appraisals, counseling skills such as emotional and listening support can enhance injured athletes' perceptions of social support. Solution-focused brief counseling (SFBC) is one type of counseling that can be used as a framework for assisting injured athletes in solving their own problems while enhancing self-determination (Gutkind, 2004). Expressive writing, cognitive processing therapy (CPT), and Koru (meditation program) may be beneficial in reducing anxiety, injury appraisals, as well as targeting other mental health concerns (Witt, 2015).

Developing Coping Skills and Resources to Intervene in Sport Injuries and Psychological Sequelae

Throughout the recognition and response phases of the psychological sequelae, interventions such as attribution training and mental toughness, modeling, social support,

self-talk, and relaxation may be successful in helping athletes cope with psychological reactions to injury via their facilitation of positive appraisals regarding injury and rehabilitation processes.

Causal Attributions and Mental Toughness Wiese-Bjornstal et al.'s (1998) integrated model of psychological response to the sport injury and rehabilitation process displays an athlete's cognitive appraisal as dictating subsequent emotional reactions and behavioral responses to injury and rehabilitation (Nippert & Smith, 2008). Attribution theory focuses on athletes' specific explanations for why events occurred and therefore why they responded with specific behaviors (Weiner, 1972). In Weiner's model, attributions fall within three categories, as determined by the causal attribution of the athlete: stability (stable or unstable), locus of causality (internal or external), and locus of control (within one's personal control or out of one's control). Attributions for rehabilitation adherence, for example, would benefit adherence behaviors when athletes perceive their abilities to adhere in adaptive ways, such as by perceiving personal control, stability, and internality over successful adherence behaviors. Thus one of the interventions that might be effective is attribution retraining to enhance injured athletes' appraisals of their rehabilitations as stable, internal, and within their control, as these are more likely lead to positive adherence behaviors in the rehabilitation process (Nippert & Smith, 2008) and less negative affective responses to rehabilitation (Ivarsson et al., 2017).

Mental toughness has been described as a positive characteristic related to increased performance, well-being (Stamp et al., 2015), and problem-focused coping strategies (Nicholls, Polman, Levy, & Backhouse, 2008). In sport injury rehabilitation, mental toughness links to athletes' pain coping (Levy et al., 2006). The psychological characteristics of hardiness and optimism are related to mental toughness (Nicholls et al., 2008), with athletes high in hardiness and optimism showing higher levels of resiliency to stressful situations, using more problem-focused coping, and resulting in higher levels of coping self-efficacy (Nicholls, Levy, Polman, & Crust, 2011). Conversely, mental toughness may also lead injured athletes to ignore pain and minimize their injuries (Madrigal, Wurst, & Gill, 2016). Individual differences in mental toughness, hardiness, and optimism influence psychological reactions and responses to sport injury (Madrigal & Gill, 2014). Knowing the psychological strengths and coping behaviors, as well as monitoring injured athletes' play-through-pain mentality, sports medicine professionals can determine appropriate interventions to motivate injured athletes and facilitate positive adherence behaviors.

Modeling Driven by Bandura's (1986, 1997) development of social cognitive, and self-efficacy theories, research in physical medicine and sport injury populations prove modeling as an effective intervention to transmit values, attitudes, thoughts, and behaviors (Flint, 1999; Wood & Wiese-Bjornstal, 2017). Video coping modeling interventions have decreased patients' fear and anxiety in patients with chronic heart failure as well as increased patients' motivation to adhere to their rehabilitation program (Ng, Tam, Yew, & Lam, 1999). Live coping models allowed spinal cord patients to discuss physical and emotional challenges regarding their wheelchair and share potential solutions, enhancing patients' rehabilitation self-efficacy (Standal & Jespersen, 2008). In the specific context of sport injuries, Flint (1999) found that video coping modeling enhanced the motivation of female basketball players with ACL injuries to adhere to the rehabilitation protocol. The modeling intervention also improved injured athletes' knowledge of their personal rehabilitation needs and factors that influenced their recoveries (Flint, 1999; Wood & Wiese-Bjornstal, 2017). Further support of video coping modeling in ACLR patients showed significant increases in functional outcome scores, in addition to decreasing patients' perceptions of expected pain and increasing patients' self-efficacy post-surgery (Maddison, Prapavessis, & Clatworthy, 2006). Observing others experience similar challenges and overcome barriers provides a powerful tool for guiding athletes through recognition of their injury and physical and psychological struggles, and influence injured athletes' response and reconciliation throughout phases of rehabilitation.

Social Support From injury onset throughout the rehabilitation process, injured athletes' emotional reactions and responses change due to their varying physical and psychological needs. Social support has been defined as "the number and quality of individuals whom a person can rely on during periods of stress" (Yang, Peek-Asa, Lowe, Heiden, & Foster, 2010, p. 372). Research has identified social support as a factor that can facilitate recovery from injury while also reducing stress and improving motivation (Judge et al., 2012; Nippert & Smith, 2008; Sheinbein, 2016; Wiese-Bjornstal, 2010; Yang et al., 2010). Research has identified eight types of social support: listening support, emotional support, emotional challenge, reality confirmation, task appreciation, task challenge, tangible assistance, and personal assistance (Judge et al., 2012). Injured athletes may benefit from listening and emotional support as they grapple with injury appraisals, and athletes who are temporarily immobilized (e.g., crutches) may benefit from tangible support by receiving transportation to and from rehabilitation or help carrying groceries upstairs. Injured athletes rely on social support from coaches, athletic trainers, and physicians (Yang et al., 2010). A

recent review of literature identified the importance of sport professionals providing supportive environments in order to decrease negative psychological responses of injured athletes and improve rehabilitation adherence and chances for successful returns to play (Ivarsson et al., 2017).

Self-talk Self-talk is a psychological skill in which athletes make self-directed verbalizations. It benefits injury recoveries as a stand-alone intervention as well as in combination with other psychological interventions. Self-talk elicits both cognitive (e.g., anxiety reducing) and motivational (e.g., self-confidence increasing) functions (Wadey & Hanton, 2008). These verbalizations can improve mood and recovery time as injured athletes demonstrate self-regulation and control over their rehabilitation process (Nippert & Smith, 2008). Commonly paired with cognitive restructuring, injured athletes can use self-talk to change the negative and irrational thoughts related to injury to positive, motivational statements (Nippert & Smith, 2008). Wadey and Hanton (2008) found that injured athletes that had faster healing rates retrospectively reported using self-talk more often than those with slower rates of healing.

Relaxation Relaxation is a cognitive or somatic strategy used in injury recovery to help regulate stress and arousal levels. A review of literature found substantial evidence suggesting relaxation reduced feelings of frustration, depression, and anger through control of physiological functions such as heart rate, respiration rate, and blood pressure (Schwab Reese, Pittsinger, & Yang, 2012). Relaxation is another psychological skill that can improve injured athletes' abilities to regulate their own arousal levels through engaging in deep breathing, listening to calming music, and ridding their minds of negative thoughts. Injured athletes can engage in relaxation techniques to prepare for task-related challenges at risk of elevating arousal levels (Schwab Reese et al., 2012; Wadey & Hanton, 2008). Relaxation training helps promote greater awareness of psychological and physiological states and provide reductions in and greater control over pain (Roditi & Robinson, 2011). Types of relaxation techniques include diaphragmatic breathing, progressive muscle relaxation (PMR), autogenic training, and guided imagery. Relaxation has been paired with other psychological interventions, such as mental imagery, in post-surgical phases (e.g., regulate pain-related arousal levels and focus on successful surgical operation) and in later phases on rehabilitation (e.g., control arousal in performing sport-related tasks) (Sheinbein, 2016). Sport medicine professionals have also found positive support for relaxation in decreasing muscle tension, improving self-confidence, and increasing sport performance during the return to play phase of rehabilitation (Nippert & Smith, 2008).

Goal Setting Goal setting is a natural process used throughout all aspects of life, which sports medicine professionals and athletes have long found easy transference to the rehabilitation setting (Covassin, Beidler, Ostrowski, & Wallace, 2015). While setting goals may be innate, goal setting is a psychosocial skill improved with practice, proper focus, and direction. Research in rehabilitation has shown that setting realistic and attainable goals can improve injured athletes' perceived competence, motivation, and adherence to rehabilitation programs (Podlog et al., 2011). Process, performance, and outcome goals have been effective in guiding athletes' cognitive understanding and effort throughout the rehabilitation process while also reducing loss of athletic identity (Covassin et al., 2015). Setting appropriately matched goals to physiological healing can increase the rate of recovery (Hamson-Utley, Martin, & Walters, 2008) while enhancing perceived competence and self-esteem (Ardern et al., 2013). Sport psychologists and sport medicine professionals have reported goal setting as the most commonly used psychological interventions during injury rehabilitation (Covassin et al., 2015; Hamson-Utley et al., 2008).

Imagery Injured athletes are able to create vivid, controllable images to feel movements, and experience thoughts and behaviors mimicking real sport and rehabilitation experiences. Imagery in rehabilitation has served three functions: cognitive imagery (rehearse exercises), motivational imagery (arousal management, goal setting, and perceived competence), and healing imagery (tissue or bone healing) (Nippert & Smith, 2008; Wesch et al., 2011). Sports medicine professionals credited imagery with increasing rehabilitation adherence (Wesch et al., 2011). Injured athletes reported enhanced perceptions of control over competitive-anxiety through imaging challenging performance situations and achieving success in stressful sport-related situations (Wadey & Hanton, 2008). While athletes progress through phases of rehabilitation, imagery can substantially decrease anxiety and fear of reinjury while improving self-confidence, mental toughness, motivation, and maintaining focus throughout long, arduous, and sometimes painful rehabilitations (Nippert & Smith, 2008; Wadey & Hanton, 2008; Wesch et al., 2011).

Improving Cultural Competence to Intervene in Sport Injuries and Psychological Sequelae

Sports medicine professionals work with athletes who hold many differing beliefs and values regarding sport,

rehabilitation, and overall life. Many professional organizations identify the need for practitioners to utilize resources to provide appropriate and efficient care to athletes who may hold different beliefs or are from a different culture than the provider (Marra, Covassin, Shingles, Canady, & Mackowiak, 2010). Cultural competence has been defined as the ability to "understand and integrate differences and incorporate them into daily care and to work effectively in cross-cultural situations" (Marra et al., 2010, p. 381).

Two domains that researchers have explored regarding the need for cultural competence in professional practice are those related to athletes' gender and religiosity or spirituality. Research assessing cultural competence in athletic training suggested the need for educators and employers to develop diversity-training tools to increase professionals' knowledge and awareness of working with and treating culturally diverse athletes (Marra et al., 2010). Witt (2015) expressed that female athletes experience additional stress due to gender stereotypes, bias, misconceptions of sexual orientation, and societal expectations of body image. Research in the role of religiosity/spirituality in coping with sport injury found that athletes who identified as either religious and/or spiritual experienced more adaptive coping behaviors and found solace during rehabilitation through their religiosity/spirituality relationships (Wiese-Bjornstal, Wood, White, Wambach, & Rubio, 2018). Research in sport psychology expressed the potential consequences that neglecting athletes' spirituality could pose on athlete-practitioner relationships (Watson & Nesti, 2005). As professionals consider individual differences in injury recovery salient, the cultural differences of athletes are also vital to providing holistic care and treatment to injured athletes.

Utilizing Professional Roles to Intervene in Sport Injuries and Psychological Sequelae

Beyond overviewing the types of psychological interventions employed in the promotion of effective sport injury recoveries, it is important to consider the professional role-related ethics and responsibilities of those using these strategies. Thus, this portion of the chapter reviews literature on the psychological roles and responsibilities of athletic trainers and athletic therapists, sport coaches, sport psychologists, sports medicine physicians, physical therapists and physiotherapists, sports medicine physicians, and strength and conditioning coaches.

Athletic Trainers and Athletic Therapists Athletic trainers/therapists (ATs) are in one of the best positions to provide psychological interventions and support to injured athletes (Arvinen-Barrow, Massey, & Hemmings, 2014; Clement et al., 2012). These professionals in many cases such as intercollegiate sports are present immediately after injury onset and throughout the entire rehabilitation process. Therefore, ATs are in a position to educate athletes about their injury, facilitate adaptive appraisals and coping, and set appropriate goals for each phase of healing. These goals should match with psychological interventions to improve injured athletes' self-determination (Arvinen-Barrow et al., 2014; Clement et al., 2012; Hamson-Utley et al., 2008; Hayden & Lynch, 2011). Owing to the centrality of ATs in the sports medicine team, they serve as the primary team member that connects each sports medicine professional working with an injured athlete, facilitating a holistic treatment team and environment. ATs' primary counseling role is to develop effective and trusting relationships with injured athletes by focusing on the athlete first, and on the injury second (Shelley et al., 2003). ATs' professional competencies include all interventions discussed in this chapter, and it is appropriate to assist in injured athletes' psychological responses and recovery (Washington-Lofgren, Westerman, Sullivan, & Nashman, 2004), while identifying when referrals to qualified mental health professionals are needed (Arvinen-Barrow et al., 2014).

Sport Coaches Coaches are most often present for injury occurrence; however, they are very limited in their involvement in the rehabilitation process (dependent on sport type and level). As athletes have reported the importance of social support from coaches (Yang et al., 2010), there seems to be a need for the involvement of coaches throughout each stage of the rehabilitation process. Programs such as the Fédération Internationale de Football Association (FIFA) 11+ in soccer have insisted that coaches play a major role in injury education and prevention, yet there is surprisingly little research on the specific roles of coaches once injuries happen. Specific to the later stages of rehabilitation, evidence suggests that coaches become more actively involved in athletes' return to play (RTP) protocols (Podlog & Dionigi, 2010; Podlog & Eklund, 2007). Hayden and Lynch (2011) recommended that ATs and coaches could facilitate final stages of injury recovery and RTP by understanding injured athletes' self-determined motivational needs. Coaches providing support and displaying their understanding of the emotional responses and performance stressors during injury rehabilitation can help create a smooth transition of athletes back into training and competition (Hayden & Lynch, 2011).

Sport Psychologists The sport psychology consultants' primary role is to assist in the psychological process of athletes' preparation for competition (Zakrajsek, Martin, & Wrisberg, 2016), which includes the psychological and

emotional demands of sport, sport injury, rehabilitation, and RTP. During the rehabilitation process, sport psychology consultants are proficient in providing psychological interventions such as relaxation, imagery, attribution training, and social support (Arvinen-Barrow, Hurley, & Ruiz, 2017; Schwab Reese et al., 2012; Zakrajsek et al., 2016) to control injury-related stress and anxiety. Sport psychologists have also been beneficial in guiding athletes' emotional processes after career-ending injuries (Arvinen-Barrow et al., 2017).

Sports Medicine Physicians Orthopedists and team physicians are among the first professionals to identify and discuss injury-related emotional disturbances with athletes postinjury (Mann, Grana, Indelicato, O'Neill, & George, 2007). While it is common that physicians may not have a relationship with the athlete until injury onset, there is increased importance for physicians to have open communication with injured athletes and discuss the effect of stress and potential psychological variables present after injury. Research shows that the majority of sports medicine physicians create safe environments where injured athletes feel comfortable discussing injury-related emotional and behavioral issues (Mann et al., 2007).

Physical Therapists and Physiotherapists Similar to athletic trainers, physical therapists/physiotherapists (PTs) are in direct contact with athletes throughout all phases of injury rehabilitation. PTs, however, have reported on their lack of specialized training in psychological aspects and interventions related to sport injury (Arvinen-Barrow, Penny, Hemmings, & Corr, 2010; Hamson-Utley et al., 2008). Of the psychological interventions used by PTs, goal setting and self-talk are the most commonly used (Lafferty, Kenyon, & Wright, 2008). Research over the last decade has highlighted the need for curriculum changes and specialized professional practice training for PTs in psychological interventions pertinent to improving motivation, self-efficacy, and injury recovery (Arvinen-Barrow et al., 2010; Chan, Lonsdale, Ho, Yung, & Chan, 2009; Hamson-Utley et al., 2008).

Strength and Conditioning Coaches Analogous to sport coaches, strength and conditioning coaches may be present for injury occurrence and professionally absent for the initial phases of rehabilitation. A holistic approach including a variety of sports medicine professionals is widely popular. However, each professionals' role may change depending on the needs of the injured athlete. Injured athletes indicated various forms of social support they desire from the strength and conditioning coach, such as recommending sport-specific exercises during the retraining phases of rehabilitation (Judge et al., 2012). The two specific forms of social support, task challenge and task appreciation, were deemed most important for strength coaches to provide during injury recovery (Judge et al., 2012). Providing task-related feedback and encouragement is also successful in improving athletes' RTP self-confidence (Judge et al., 2012) and reducing fear of reinjury.

In sum, psychological interventions such as counseling, mental skills, and cultural sensitivity are essential in the management of sport injuries and psychological sequelae. Further, many different sport and medical professionals have important roles and responsibilities in the mental and physical recoveries of injured athletes.

Conclusions Concerning Sport Injuries and Psychological Sequelae

This chapter reviewed negative and positive sequelae subsequent to sport injuries through the lens of research and professional practice literature and characterized these sequelae as part of a larger field of study called sports medicine psychology (Wiese-Bjornstal, 2014). There are substantial inconsistencies within this literature regarding the defining events (i.e., sport injuries). A working definition presented in this chapter described sport injuries as bodily tissue damage or functional impairments that occur in consequence of sport activities, often limited in research to reportable events that receive medical care and result in loss of time or capacity relative to engagement in sport activities. Seven sport injury-specific models have predominated in the literature in terms of providing conceptual frameworks for research and professional practice interventions involving the psychological sequelae of sport injuries. These included grief models (Pedersen, 1986; Rotella & Heyman, 1986), affective cycle of injury (Heil, 1993), integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal & Smith, 1993), integrated rehabilitation model (Flint, 1998), biopsychosocial model of sport injury rehabilitation (Brewer et al., 2002), disablement in the physical active model (Vela & Denegar, 2010b), and the decision-based model of return to play in sport (Creighton et al., 2010).

A sport injury lifespan and psychological sequelae model (Wiese-Bjornstal, 2017b) provided a way to integrate conceptual frameworks and research approaches into an emerging temporal schematic of a sport injury lifespan. This model merged tissue healing and health-care phases with psychological response and injury narratives across the lifespan of a sport injury. It also connected psychological skills and interventions to the specific psychological challenges

evident during different phases from preinjury through recovery and even retirement. Research literature on psychological risk factors and sequelae before, during, and after sport injuries illustrated how thoughts, feelings, actions, and social influences evidenced across the phases.

Assessments with relevance to evaluating and understanding sport injuries and psychological sequelae included a variety of athlete self-report and sports medicine-provider report instruments that could be used not only by researchers but also by sport professionals in different roles, such as sport psychologists, sport coaches, and sports medicine providers. Evidence-based intervention strategies identified for use by sport psychologists, sport coaches, and sports medicine providers included offering counseling, developing coping skills and resources (e.g., modeling, goal setting), improving culturally competence in professional practice, and utilizing professional roles to benefit sport injury recoveries.

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