

Systematic review of stress-related injury vulnerability in athletic and occupational contexts



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ABSTRACT

Injury is a pervasive, expensive and, to some extent, preventable problem. Stress is a psychological risk factor for injury but little is known about how stress processes compare in athletic and occupational contexts. This paper reviews research on stress-related injury vulnerability in athletic and occupational contexts to characterize and compare samples, methods, and conclusions from the perspective of an integrated model of stress-related injury vulnerability. A comprehensive search of four major databases identified research in both athletic ($n = 34$) and occupational contexts ($n = 22$). Studies were coded to extract characteristics of the samples, research designs, measures, and conclusions about stress-injury relations. Studies used more prospective than cross-sectional or case control research designs. Injury was most frequently defined as missing one subsequent day of training or work (35.7%). Approximately 75% of the identified studies in each context indicated a positive association between stress and injury occurrence. The consistency of findings suggested a robust stress-related injury vulnerability for both exposures and responses, however, caution is warranted due to the diversity of measures and surveillance periods and the lack of experimental designs. New hypotheses are identified to refine models of stress-related injury vulnerability in athletic and occupational contexts.

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Contents

1. Introduction	37
1.1. Injury as a public health concern	38
1.2. Etiology of injury	38
1.3. Defining stress	38
1.4. Models of stress as a risk factor for injury	38
1.5. Empirical support for stress as an injury risk factor	39
2. Methods	39
3. Results	39
3.1. Athletic context	39
3.2. Occupational context	40
4. Discussion	41
Funding	42
Conflict of interest	42
Supplementary data	42
References	42

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1. Introduction

Injury is a pervasive, expensive and, to some extent, preventable

problem. Although some musculoskeletal injuries may be unavoidable, others may be preventable if risk factors can be identified. Physical activity has a dose-response association with injury risk (Hootman et al., 2001). Occupational activity has historically accounted for the majority of physical activity but some people derive their activity largely from leisure activities such as athletic participation (Church et al., 2011; Rovniak et al., 2010). In both contexts, injury risk is influenced by external and internal factors (Bahr & Krosshaug, 2005). Stress is among the internal factors that contributes to injury vulnerability but it has received limited scientific or clinical attention relative to other internal or external risk factors (Ivarsson et al., 2017; Leppänen, Aaltonen, Parkkari, Heinonen, & Kujala, 2014). It is not clear how the scope of research on stress-related injury vulnerability from these domains compares with respect to research designs, sample sizes, or measures. This paper systematically reviews the scope of research on stress-injury relations in athletic and occupational contexts.

1.1. Injury as a public health concern

Injury is the leading cause of death among American persons in the first half of life (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2016a). The National Center for Injury Prevention and Control estimated that 26.9 million people were treated in emergency departments and 2.5 million people were hospitalized due to injuries in 2014 (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2016b). In the United States, there are an estimated 8.6 million injuries in sport and related recreational contexts and 2.8 million injuries in occupational contexts (Bureau of Labor Statistics, 2016; Sheu, Chen, & Hedegaard, 2016). Musculoskeletal injuries impose physical and behavioral limitations. Psychological responses vary widely but can involve serious mental health concerns such as changes in identity, emotional disturbances (especially elevated depression or anxiety), substance abuse, and disordered eating (Chin et al., 2017; Putukian, 2016; Wiese-Bjornstal, 2010). Injuries also have an alarming economic toll. The total costs of injuries in the United States are estimated at \$671 billion, with over 68% attributable to nonfatal injuries (Florence, Haegerich, Simon, Zhou, & Luo, 2015). When looking at the costs of injury both physically and financially, it is evident that prevention strategies that address injury risk factors are needed.

1.2. Etiology of injury

To the casual observer, injury may seem to be the product of accidents or bad luck; however, a number of factors contribute to injury risk. These risk factors can be described as either external or internal (Bahr & Krosshaug, 2005; Kumar, 2001). External risk factors originate outside of the person; examples include the weather, use of protective equipment, and type of sport. Internal risk factors are characteristics of the individual; examples include biomechanics, conditioning, maturational stage, somatotype, and psychological factors. Stress responses have emerged as an internal, psychological risk factor for injury in athletic and occupational contexts (Ivarsson et al., 2017; Johnston, 1995). This paper seeks to describe the scope of research on stress-injury relations in athletic and occupational contexts so critical gaps can be identified to guide future research.

1.3. Defining stress

Stress processes can be difficult to define and even more difficult to measure. Selye (1978) defined stress as “the nonspecific response of the body to any demand” (p. 2). The diversity of nonspecific

responses has proven to be a challenge for research and research synthesis. Stressors refer to the sources of stress, and include both daily stressors and major life events. Daily stressors involve the more mundane problems encountered in daily life (e.g., unexpected deadlines, traffic jams, arguments with significant others; Almeida, 2005). These stressors can contribute to an immediate spike in affective responses associated with distress (Lazarus & Folkman, 1984). Major life events include child abuse, death of a loved one, and job loss (Almeida, 2005). These stressors are less common and can elicit different and more prolonged stress responses than daily stressors.

Not all stressors elicit the same psychological response. Some stressors raise anxiety levels whereas others can raise depression or anger (Lazarus & Folkman, 1984). The specific nature and intensity of stress responses is influenced by how a person appraises a stressor and their coping potential (Lazarus & Folkman, 1984). The extent to which stressors are perceived as more threatening or harmful should influence the magnitude of corresponding stress responses. Thus, exposure to stressors and stress responses (i.e., reactivity) are separable constructs but inseparable elements of daily stress processes.

1.4. Models of stress as a risk factor for injury

Stress has been proposed as a psychological risk factor for injury in athletic and occupational contexts. The stress-injury model posits that potentially stressful situations generate stress responses based on the athlete's perception of the situation (Andersen & Williams, 1988). An updated version of this model expanded on the complex influences of personality, coping resources, and historical exposure to life stress in creating a vulnerability to stress responses (Williams & Andersen, 1998). This stress response involves neuromuscular and attentional changes that increase acute injury risk. The biopsychosocial model of stress and athletic injury and health offers a broader range of mechanisms by which stress elevates risk for illness and injury, including physiological changes (e.g., stress hormone perturbation, immunosuppression, impaired skeletal muscle repair, peripheral narrowing) and behavioral changes (e.g., impaired self-care, poor sleep quality, treatment noncompliance) (Appaneal & Perna, 2014). Stress may engage different mechanisms to impact these health outcomes. For example, attentional changes may increase risk for acute injury, impaired skeletal muscle repair may heighten risk for overuse injuries, and immunosuppression may elevate risk for illness.

An occupational model by Nakata et al. (2006) also proposed that stress heightens risk for injury. Similar to the athletic models, stressors lead to acute reactions, such as physiological and behavioral changes, that culminate in illness and injuries. Each of these models frames stress as a risk factor for injury in athletic and occupational settings. Fig. 1 integrates the common features of those models with research on daily stress processes. In this model, injury risk is expected to be positively associated with both stress

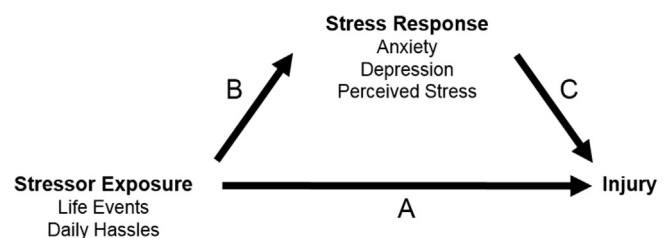


Fig. 1. Integrated model of stress-related injury vulnerability in athletic and occupational contexts.

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