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Measuring Psychological Load in Sport

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Abstract

Monitoring the physical load undertaken by athletes and examining the subsequent relationship with performance and injury and illness risk is common practice in high performance sport. Less attention has been paid to the psychological factors contributing to the overall load experienced and the impact upon health status and performance. This paper discusses considerations for the conceptualisation and measurement of psychological load in sport. First, we outline the importance of ensuring conceptual clarity is adopted in the measurement of psychological load. Next, we discuss the challenges to measuring psychological load in a comparable manner to which physical load is currently evaluated, including use of subjective assessment, adoption of specific and global approaches, and development of measurement instrumentation, techniques, and expertise. We then offer recommendations for practitioners when undertaking assessment of psychological load in sport. We conclude with future research directions to advance the study and measurement of the construct, including the interaction between psychological and physical load, the appraisal of the load faced and personal and social resources available to successfully cope. We also highlight the need to consider groups of athletes (e.g., transitioning athlete, long-term injured) at greater risk from threats to mental and physical health from increased psychological load.

Keywords

Athlete monitoring, well-being, life load, health, performance, injury

Introduction

Traditionally, common practice in high performance sport has been to adopt a focus on monitoring the athlete for readiness purposes through the external physical load undertaken in preparing for, and taking part in, competition, and examining the relationship this load has with subsequent performance and risk of injury and illness [1,2]. Here, external physical load is viewed as the total physical stressors and demands applied to the performer, which can comprise sport and non-sport related sources. A failure to maintain a balance between the load an athlete is exposed to and their subsequent recovery can lead to extended fatigue and abnormal training responses (maladaptation), thereby increasing risk of injury and illness [3]. Although a wealth of scientific literature and allied knowledge exists investigating the relationship between physical load and injury and illness in sport [4], to date, there has been comparatively less recognition of the psychological factors that contribute to the overall load athletes experience [5]. Verhaegen and Gabbett [6] have argued that in order to better comprehend the complex relationship between load, performance and health, consideration of factors beyond physiological indices is required, which include subjective (athlete-reported) outcomes (e.g., rate of perceived exertion), lifestyle-related factors (e.g., diet, sleep) and psychological indices (e.g., stress, coping mechanisms). Given the potential to further understand the contribution of these psychological indices, which include the psychological load encountered, together with the growing emphasis placed on athlete mental health and well-being in elite sport (see e.g., [7]), the aim of this paper is to discuss some considerations for the conceptualisation and measurement of psychological load in sport. Specifically, we seek to encourage those who typically measure and manage load through physical parameters to also consider the psychological load encountered, and how such a perspective can be incorporated within existing research and practice to better understand how an athlete will subsequently respond and adapt. First, we outline the importance of ensuring conceptual clarity is adopted in the measurement of psychological load. Next, we consider some challenges to measuring psychological load in a comparable manner to which physical load is currently assessed. We then offer recommendations for practitioners when undertaking assessment of psychological load in sport. Finally, we conclude with some directions for future research which we feel require attention to further our understanding of psychological load.

Conceptual clarity

Establishing conceptual clarity regarding the assessment of psychological load is vital for researchers and practitioners to have confidence in the validity of the construct of interest and the rigor of subsequent measurement instruments developed. For the purposes of this paper (see Table 1), we use Quarrie et al.'s (p. 2) definition of 'load' as the total stressors and demands applied to the athlete, which can comprise sport and non-sport related sources and take physical, mechanical and psychological forms. Therefore, we refer to psychological load as the total psychological demands an athlete faces associated primarily and directly with their life inside and out of sport. Further, in line with Quarrie et al.'s suggestion, an individual's response to a load applied may be measured through either 'objective' or 'subjective' monitoring. Therefore, we suggest that researchers and practitioners seek to 'measure' the loads applied to athletes and also monitor an individual's response to the load.

When discussing psychological load, it is important to note issues relating to stress terminology to ensure conceptual clarity. That is, there is a difference between the terms psychological 'load' and 'stress.' Stress has often been used interchangeably to describe a stimulus or load (e.g., 'how much stress are you faced with?') or a response (e.g., 'how stressed are you today?') of a person-environment interaction, despite there being a clear conceptual distinction between the terms. Contemporary conceptualizations [8] define psychological 'stress', as "an ongoing process that involves individuals transacting with their environments, making appraisals of the situations they find themselves in, and endeavouring to cope with any issues that may arise" ([9]; p. 9). Appraisal refers to one's perception of the extent to which an event or situation is stressful, and the potential impact on personal goals and resources. Coping refers to constantly changing cognitive and behavioural efforts to manage specific external and internal demands appraised as taxing or exceeding the resources of the individual. According to such conceptualizations, stress reflects an umbrella term for the ongoing transactional process between a person and their environment and encapsulates several core components, including stressors, appraisals, responses and coping efforts. In contrast, psychological load is viewed as the stimulus received (i.e., stressors or demands) by the individual within the stress process.

In the sport psychology discipline, a considerable body of work has examined the stressors or demands (e.g., the sources of the psychological load) that athletes experience in relation to their training and competition (see [10] for a review). These demands have been classified as

emanating from three sources: organization, performance and personal [11]. Organization demands are associated primarily and directly with the sports organisation within which the performer operates (e.g., wages, finance). Performance demands are associated primarily and directly with competitive performance (e.g., opponents, officiating decisions). Personal demands are associated primarily and directly with non-sporting life events away from the sport environment (e.g., family, social, study). Within each of the categories of organisation and performance demands, a comprehensive framework has been developed [12,13] to describe the origins of these different stressors. Specifically, organization demands emanate from issues related to leadership and personnel, culture and team, logistics and environment, and performance and personal matters. Performance demands are categorized as deriving from sources related to preparation, injury, expectation, self-presentation, and rivalry. Allied with these frameworks, a body of work has emerged which has identified numerous distinct performance and organizational demands [12,14]. For example, over 640 distinct organisational demands have been identified, with differences in the type, intensity, and frequency of the organisational and performance demands faced by athletes across a number of demographic identifiers including gender, sport type (team versus individual) and skill level [12,15]. Elite athletes also report proportionately more performance and organisational demands than their non-elite counterparts, with issues such as level of preparation, travel, accommodation, and funding emerging as more prevalent for those competing at higher levels [13,15]. While research has focused on performance and organisation demands, less attention has been dedicated to examining the personal demands elite athletes face away from training and competition. Studies with different sports (e.g., ice skating, Australian rules football) have identified demands associated with personal relationship issues, family disturbances, sport and education imbalance, finances and traumatic experiences [16,17], while the number (total count) and severity of lifetime stressor exposure has recently been shown to predict greater depression and anxiety symptoms, and worse well-being in elite athletes [18].

In summary, conceptual clarity is required when discussing psychological load, and we recommend that this load should be considered in terms of the type (or source) of the demand (i.e., stressor), the intensity or extent of the demand (i.e., ‘load’) that an individual perceives, and the duration (i.e., length) and frequency to which the intensity of that demand is experienced.

153 ***TABLE 1 HERE***
154
155 **Measurement**
156
157 A starting point to consider the measurement of psychological load is to look at how other
158 forms of load are currently measured and monitored in sport. If we consider the measurement
159 of athletes' physical load and the subsequent monitoring of their response to this load,
160 commonly accepted and adopted techniques in research and practice include: GPS systems to
161 measure external training and match loads, and session rating of perceived exertion (sRPE) to
162 monitor athlete responses to these loads. In respect of measuring physical load, researchers
163 and practitioners are able to objectively quantify the extent of load placed on an athlete (e.g.,
164 via total distance covered, maximum velocity achieved) and subjectively monitor the
165 athlete's response to that load (how they experienced the intensity of the load as a function of
166 the duration of the activity). Given the large range of types or sources of psychological load
167 identified as faced by athletes [12,14], attempting to quantify (similar to the measurement of
168 external physical load) the external psychological load placed on an individual from each of
169 these unique sources may be a difficult and potentially futile avenue of inquiry, particularly
170 for practitioners facing time and resource constraints. Attempts to use physical markers to
171 measure psychological load (i.e., cortisol stress response) are also likely to be confounded by
172 any physical exercise undertaken. Instead, a more viable approach would be to monitor
173 athletes' perceptions of the psychological load faced (i.e., internal psychological load).
174 Typically, in the psychology literature, this is undertaken through the use of survey-based
175 methods which invite athletes to respond in terms of their perception of the stressors or
176 demands (*sic* load) experienced.
177
178 The first challenge in monitoring responses to the psychological load faced therefore is
179 establishing what the athlete is being asked to respond to. Given the plethora of types of
180 demands or load reported to be experienced, here researchers can look to adopt either a
181 specific or global measurement approach. A specific measurement approach would seek to
182 ask an athlete to first identify the particular types of psychological demands they were facing
183 and then to indicate the extent to which that psychological demand was being placed upon
184 them. In the sport psychology literature numerous survey-based measures exist which may
185 serve this function, such as the stressor checklist [19]. When completing this survey, an
186 individual is asked to consider the range of demands that they are experiencing and to rate the

intensity to which these sources are viewed as demanding. Outside of sport, measures exist such as the Stress and Adversity Inventory for Adults (Adult STRAIN), which assesses lifetime stress exposure, and has displayed good psychometric properties (see [20]). While such an approach enables researcher-practitioners to capture the unique types of demands and subsequent load experienced by athletes it makes intra- and inter-individual comparison problematic when seeking to develop an arbitrary unit of load for comparative purposes to any physical load assessment. Moreover, from a practical perspective the use of such measures on a regular (e.g., daily) and long term basis with athletes may be deeply problematic due to the length of the measures and the time taken to complete them (e.g., Adult STRAIN contains up to 220 items and takes approximately 18-25 minutes to complete).

An alternative approach to the specific measurement of the psychological load faced by athletes is to consider a more global assessment focusing on the overall extent of the psychological demand an athlete feels they are experiencing. For example, using a sport versus non-sport dichotomy (see Table 1) and adapting items from existing measures used in experimental tasks [21], athletes can be asked to indicate how demanding they feel their life is both in (sport load) and outside (life load) of their sport. This would then broadly capture experiences of load in relation to the performance, organizational and personal domains identified in the existing literature [12], albeit with less typological nuance.

When establishing what specifically to monitor in respect of the psychological load experienced by athletes, the methods by which responses are reported also poses challenges. Typically, a Likert scale is used in social science research for participants to indicate the extent or intensity of the load experienced, often with descriptive anchors such as ‘not demanding’ or ‘very demanding’ [22]. Such a rating scale approach differs to the rating scales (e.g., Rating of Perceived Exertion, RPE) used to monitor physical load in research and clinical settings [23]. One option to provide alignment here may be the adoption of the Rating Scale for Mental Effort (RSME; [24]) commonly used in other branches of psychology, and the ergonomics domain in particular, to assess the subjective mental workload of tasks. The RSME comprises a vertical axis scale ranging from 0–150, with participants marking a point on the scale indicative of the mental effort invested in the task performance. The RSME has demonstrated a degree of reliability and validity in its use as an index of mental workload [25].

A further issue in the measurement of psychological load, in comparison to that of physical load, is the ability to account for the assumed temporal nature of the construct. Physical internal load is calculated, for example, by multiplying the athlete's rating of the session intensity by the duration of that session undertaken in order to calculate the session RPE (sRPE) and derive an arbitrary unit of load. In psychological load terms it is difficult to make an equivalent calculation to quantify the duration to which the load was experienced, as an individual may not only have faced psychological demands within a training session or competition explicitly, but may have faced these demands while travelling to the training venue, or during changing or warming up, or even away from the sporting environment altogether. It follows that explicitly asking athletes to indicate how psychologically demanding a training session or competition was and multiplying that rating by the length of the session will give an arbitrary unit (AU) value for comparative purposes with physical load. Yet, attempting to quantify the load experienced away from training and competition ('life load'), would seem more problematic in terms of establishing the period of time (i.e., duration) to which an athlete rates the extent to which that stressor was demanding. We note here that this problem is not unlike that faced by researchers attempting to consider the physical load undertaken by athletes away from their sport. Further, given the dynamic nature of the psychological stress process [8] reflecting changes in the type, intensity, duration and frequency of the (sources of load) demands experienced, attempting to derive an accurate measure of the psychological load and monitor the subsequent response to this load becomes even more problematic.

A final consideration is that the psychological load faced by an athlete merely represents one facet of the psychological stress process. Indeed, there is a vast body of literature already in existence in the psychology discipline that tells us that load, in respect of the demands faced, is only one part of the picture [26]. Lazarus' [8] perspective on stress posits one's cognitive appraisal of the demand faced (e.g., challenge versus threat) as central to impacting upon the experience of emotion and coping behaviour (*sic* performance). Consequently, every individual perceives his or her environment differently and therefore has to choose his or her response strategy accordingly to cope with the load faced. The ability to cope with the load faced will depend on the level of personal (life experiences, previous level of exposure to adversity) and social resources (amount and quality of support networks available) the individual possesses. In this respect, to better predict performance (and health) outcomes,

monitoring an athlete's response to a psychological load may also be enhanced by directing attention towards how they appraise and subsequently cope with the load faced, rather than gauging the interpretation of the extent (intensity) of that demand placed upon them [27].

Given the potential complexity surrounding the concept of psychological load, and the challenges in measuring the construct, we conclude this section by offering a number of implications for practitioners seeking to undertaking assessment of psychological load in sport (Table 2).

TABLE 2 HERE

Future research

So far in this commentary we have sought to discuss the conceptualisation of psychological load and offer considerations for its measurement. We now focus on areas which we feel require further investigation to developing greater understanding of the construct. First, in seeking to fully understand the types of psychological load experienced, more research is needed to classify the life load athletes face. While research to date examining the psychological demands (~~/~~stressors) faced by athletes has focused on performance and organization demands, less attention has been dedicated to examining the personal demands elite athletes face away from training and competition [16,17]. This is despite athletes reporting a ratio of approximately 3:1:1 in the frequency of organizational:performance:personal stressors [28]. Although research related to personal stressors has considered the role of life-load (adverse life events) upon the athlete [18,29,30], further consideration is needed to capture the breadth of the non-sport load faced, and the extent to which these personal stressors impact athletes' performance and well-being.

In developing a better understanding of the nature of the construct a suitable approach is then needed to be able to capture the psychological load athletes experience (sport and life load). As discussed, current approaches predominantly rely on the use of existing measures not specifically designed for explicit assessment of psychological load and which merely assess the intensity of the load experienced or the response to load [31], failing to consider the duration of which that demand is experienced. Where specific measures do exist, with strong psychometric properties, such as the Organizational Stressor Indicator for Sport Performers

(OSI-SP; [32]), only the organisational sources of load experienced in the sporting environment (environmental stressors) are considered, and the duration of occurrence of the demand assessed qualitatively (e.g., "how long did this pressure place a demand on you for?"; 0 = no time, 5 = a very long time). Clearly, a priority for future research therefore is the development of a measure of the psychological load experienced in sport, together with examination of the utility of existing measures of life load (e.g., adult STRAIN) for application to athletes [18].

In the development of a valid measure of psychological load, consideration is also needed for instruments which have clinical as well as scientific utility. For example, while brief measures are in common use in elite sport to measure the psychological response to the physical training load (e.g., perceptual fatigue, [33]), they do not consider the psychological nature of the 'dose' experienced. Outside of the sport domain, measures of subjective mental workload, such as the NASA Task Load Index (NASA-TLX; [34]), are used in the human factors field. The NASA Task Load Index is a multidimensional rating scale based on six subscales (mental workload, physical workload, temporal workload, subjective rating of performance, effort and frustration), that has undergone extensive validation procedures (see [35] for a review) and has successfully been adapted for use in other occupations (e.g., surgery; [36]). Scope exists therefore to explore its utility in relation to assessing the psychological load associated with sporting performance.

Construction of conceptually-aligned, rigorous and practical measures of psychological load will allow exploration of how such information can be combined with the measurement and monitoring of external and internal physical load to provide a more comprehensive understanding of the relationship between load, performance and well-being (injury and illness – physical and mental) – both in acute and chronic time contexts [37,3]. While literature already exists independently in sports medicine and sports psychology regarding the acute and chronic psychological and physical responses to load, such as fatigue, overtraining, and burnout [38,3], research into the contribution of psychological load to the overall training stimulus and subsequent effect upon adaptation performance and well-being is needed. Identification of groups of athletes who may be at greater risk from threats to well-being from increased psychological load, is of particular salience, and may include athletes transitioning in (i.e., academy, junior elite) and out (i.e., retirement) of elite sport and those athletes classified as long-term injured [30,39].

A final consideration for future research is that while our commentary seeks to discuss how load can be potentially measured from a psychological perspective, comparable to that of physical and mechanical load, the load faced represents only one facet of the psychological stress process. In this respect, to better predict performance and health outcomes, monitoring an athlete's response to a psychological load may be best suited by directing attention towards how they appraise the load faced and the personal and social resources available to successfully cope, rather than gauging the interpretation of the extent (intensity) of that demand placed upon them [27]. Once a better ability to monitor the psychological load experienced (and the subsequent appraisals of the load) has been developed, research can then seek to explore the effect of load modification upon performance and health outcomes. Here, primary interventions can be examined that seek to reduce the psychological load experienced by the athlete (e.g., modifying training-related demands), together with secondary interventions that aim to build effective psychological skills (e.g., stress management training) to cope with the (psychological and physical) load faced [26].

Conclusion

In order to better comprehend the complex relationship between load, performance and health in sport, consideration of factors beyond physiological markers is advocated, including the role of psychological indices (e.g., the psychological demand placed upon the athlete inside and outside of sport). To facilitate this process, we have discussed the importance of conceptual clarity in order to set the foundation for the measurement of psychological load. Specifically, we advocate psychological load is viewed as the total environmental demands that an athlete faces and should be considered in terms of the type, intensity, duration and frequency with which it is experienced. Challenges to measuring psychological load include: taking objective versus subjective assessment; the adoption of specific or global approaches; and the development of measurement instrumentation, techniques, and expertise. Practitioners are advised to adopt global approaches to monitor the internal response to the psychological load experienced, from both in and outside of sport, and acknowledge the central role of appraisal and the personal and social resources available to the athlete to successfully cope. Future research is needed to consider the interaction between psychological and physical load and the combined impact upon performance and well-being (incorporating injury, illness and health) in both acute and chronic contexts, with

consideration to those groups of athletes potentially at greater risk from threats to physical and mental health from increased psychological load (the transitioning athlete, long-term injured).

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Table legends

Table 1. Key terms and definitions in relation to the measurement of psychological load.

Table 2. Implications for practitioners seeking to assess psychological load.

Conflict of Interest

The authors guarantee, beyond the absence of any conflict of interest, that this manuscript was built based on the IJSM ethical standards (Harriss DJ, Macsween A, Atkinson G. Ethical Standards in Sport and Exercise Science Research: 2020 Update. Int J Sports Med 2019; 40: 813-817).

510 **Table 1. Key terms and definitions in relation to the measurement of psychological load**
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Term	Definition
Load	• Total stressors and demands applied to the performer, which can comprise sport and non-sport related sources and take physical, mechanical and psychological forms.
Psychological load	• Total psychological demands that an athlete faces in terms of the type, intensity, duration and frequency with which the demands are experienced.
Sport load	• The psychological demands that an athlete faces from their sport in terms of the type, intensity, duration and frequency with which the demands are experienced.
Life load	• The psychological demands that an athlete faces away from their sport in terms of the type, intensity, duration and frequency with which the demands are experienced.
Psychological stress	• An ongoing process that involves individuals transacting with their environments, making appraisals of the situations they find themselves in, and endeavouring to cope with any issues that may arise.
Organization demands	• Demands associated primarily and directly with the sports organisation within which the performer operates (e.g., wages, finance).
Performance demands	• Demands associated primarily and directly with competitive performance (e.g., opponents, officiating decisions).
Personal demands	• Demands associated primarily and directly with non-sporting life events away from the sport environment (e.g., family, social, study).
Appraisal	• Perception of the extent to which an event or situation is stressful, and the potential impact on personal goals and resources.
Coping	• Constantly changing cognitive and behavioural efforts to manage specific external and internal demands appraised as taxing or exceeding the resources of the individual.

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514 **Table 2. Implications for practitioners seeking to assess psychological load**
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- Monitor the athlete's (subjective) perception of the internal psychological load experienced, as opposed to attempt measurement of the objective external load placed upon the individual.

- Monitor the overall extent of the psychological load experienced, given the potential unique and vast array of sources (i.e., demands) contributing to an athlete's perception of their psychological load.

- Assess the psychological load that emanates from both participation in (sport load), and away from (life load), the sport.

- Take caution with the administration of instruments originally designed to measure psychological load in other occupations, due to their potential lack of sport-specificity and practical utility (e.g., time taken to complete).

- Consider both the psychological load experienced and the athlete's subsequent response (mental and physical) to the load, to capture any potential dose-response relationship.

- Undertake monitoring of psychological load from both an acute and chronic perspective to measure the relationship with physical load, performance, and physical and mental health (injury/illness) over time.

- Acknowledge that the appraisal of the mental and physical psychological load encountered, and the level of personal and social resources available, will influence an athlete's ability to successfully cope.

- Consider groups of athletes who may be particularly 'at risk' of physical and mental injury/illness from increased psychological load. These may include athletes transitioning into (i.e., academy, junior elite) or out (i.e., retirement) of elite sport and those athletes who are long-term injured.

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